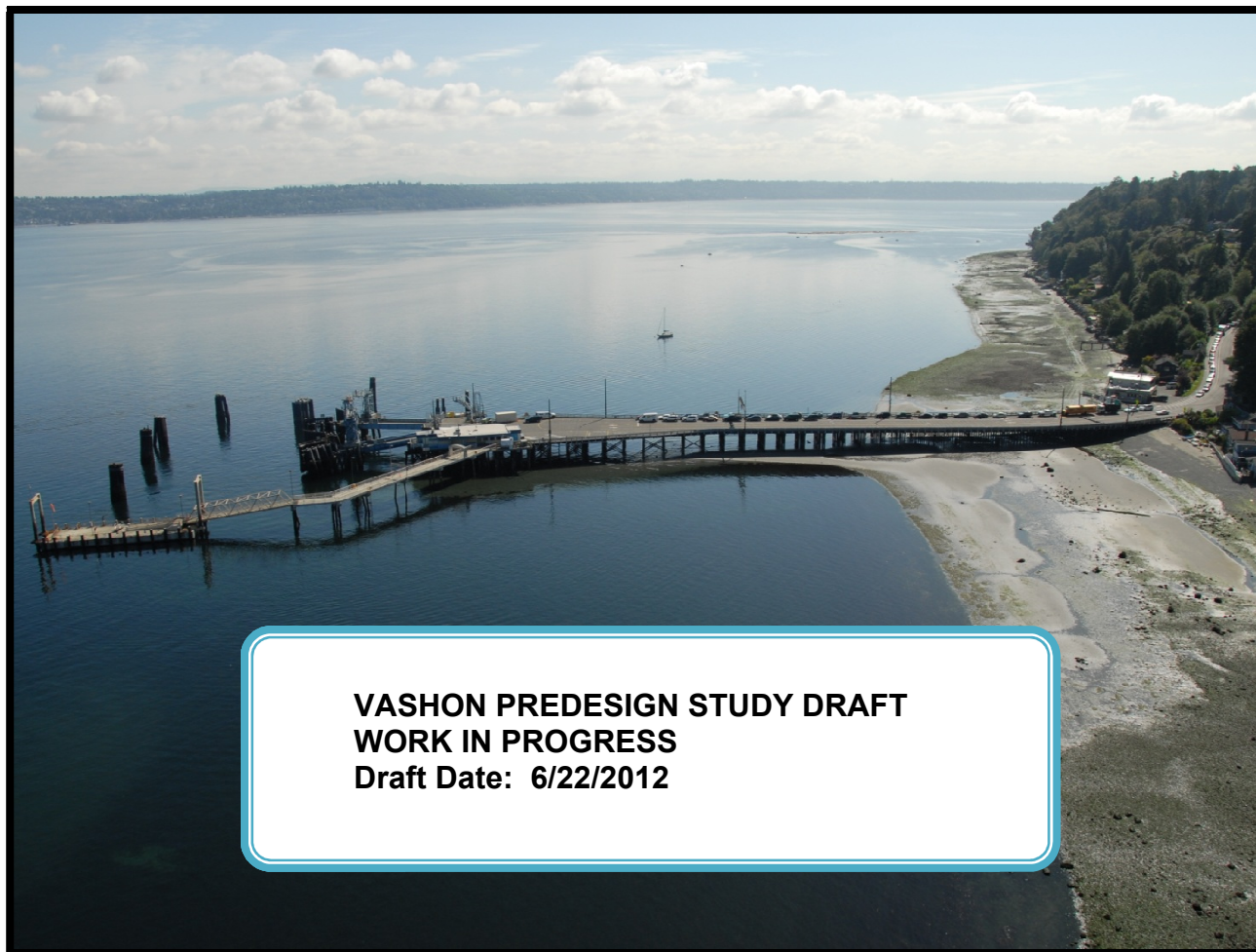


PREDESIGN STUDY

VASHON TIMBER TRESTLE & TERMINAL REPLACEMENT PROJECT



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WORK ORDER: XL3493
WIN: M05204A
10W221

Version Date: June 22, 2012
Submittal Date: June 29, 2012

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1.0 EXECUTIVE SUMMARY

The Washington State Ferries Division (WSF) of the Washington State Department of Transportation (WSDOT) has proposed the Vashon Timber Trestle Replacement Project (VTRP) as part of the preservation program for the Vashon Ferry Terminal on Vashon Island in King County. Preservation work to the Vashon timber trestle and bulkhead/seawall has been in the planning phase for almost two decades. Originally constructed in 1957, the timber trestle and timber bulkhead/seawall design provided for a structural life of 40 years when compared to current design procedures. The design life was extended after annual condition assessments conducted by the WSDOT Bridge and Structures Office and a program to replace deteriorated piles. Additionally, components of the trestle have become increasingly vulnerable to a catastrophic seismic event and do not meet current standards for environmental stewardship, Americans with Disabilities Act requirements, or current WSF design standards.

Construction of the main terminal building occurred in 1957. In 1982, the building received a renovation. The year 2023 will mark the end of the 40-year service life for the renovated building. Despite having a remaining service life of over ten years, the terminal building is located entirely on the trestle and therefore concurrent replacement of the building with the trestle needs consideration.

The Vashon Timber Trestle and Replacement Project (henceforth to be referenced as the Vashon Trestle Replacement Project or VTRP) represents one of the first Washington State Ferries (WSF) projects undertaken by the Terminal Engineering staff to address structural deficiencies occurring with aging timber structures.

1.01 Project Purpose, Need and Alternatives Considered

The purpose of the VTRP is to maintain a vital and critical transportation route that serves Vashon Island by replacing the current trestle with a new structure that meets current seismic codes. More significant is the fact that the Vashon Terminal would be lifeline for the residents and businesses on the island following an emergency and/or seismic event. The population of slightly more than 10,000 residents is highly dependent on the WSF for transportation to/from the island. The King County Ferry District operates a passenger-only ferry service on weekdays that leases a slip and trestle facilities at the Vashon Terminal. WSF has a smaller, one-slip terminal at the southern end of the island at Tahlequah that was not designed to current seismic codes when it was built in 1958. The transfer span and towers at the Tahlequah terminal were reconstructed in 1994. There are not any structures or bridges connecting Vashon Island to the mainland and the only other potential mode of public transportation is at Vashon Municipal Airport located at the northern end of the island. There is no regularly scheduled air service to the airport; however, Vashon Island Air provides an FAA Part 135 Air Charter service to and from the Island, as well as scenic tours.

The following alternatives were considered:

- Alternative 1 (No Build) – maintaining the current structure
- Alternative 2 (Rehabilitation) – seismic retrofitting of the structure with additional maintenance

- Alternative 3 (Partial Replacement) – replacing approximately half the structure, designed to seismic codes to remain functional after a seismic event and terminal building
- Alternative 4 (Full Replacement) – Includes Partial Replacement and replacement of remaining sections of trestle

Estimates of project cost for each alternative have been developed and are shown in the table below.

Table 1: Estimated Project Costs

Project Alternative	Total Project Cost
Alternative 1 - No-Build	
Alternative 2A – Seismic Bracing	
Alternative 2B - Rehabilitation	\$43.5M
Alternative 3 - Partial Replacement	\$31.8M
Alternative 4 - Full Replacement	\$43.2
Note: Above costs are in 2012 dollars.	

Key project elements, identified by WSF, allowed for direct comparison of the alternatives (summarized in the table below) and aided in the selection of a preferred alternative.

Table 2: Summary of Alternatives Matrix

Project Element	Alternative 1 No-Build	Alternative 2A Seismic Bracing	Alternative 2B Rehabilitation	Alternative 3 Partial Replace	Alternative 4 Full Replace
Description	<ul style="list-style-type: none"> No capital improvements Recurring maintenance contracts for critical areas 	<ul style="list-style-type: none"> Seismic Upgrades Only 	<ul style="list-style-type: none"> Seismic Upgrades Replace Bents Stormwater Treatment 	<ul style="list-style-type: none"> Replace approximately half of existing trestle and terminal building 	<ul style="list-style-type: none"> Replace of entire timber trestle and terminal building
Life Cycle Cost					
Cost Benefit Ratio					
Environmental	<ul style="list-style-type: none"> Long term impact of deteriorated piles/timbers in water No removal of creosote timbers or stormwater treatment 	<ul style="list-style-type: none"> Long term impact of deteriorated piles/timbers in water Additional overwater coverage 	<ul style="list-style-type: none"> Removes most creosote timber in stages Stormwater treatment Reduced benthic coverage 	<ul style="list-style-type: none"> Removes most creosote timber Stormwater treatment Reduced benthic coverage 	<ul style="list-style-type: none"> Removes all creosote timber Stormwater treatment Reduced benthic coverage

Project Element	Alternative 1 No-Build	Alternative 2A Seismic Bracing	Alternative 2B Rehabilitation	Alternative 3 Partial Replace	Alternative 4 Full Replace
Permitting/ Risk	<ul style="list-style-type: none"> No risk factors addressed No permitting Required 	<ul style="list-style-type: none"> Seismic risk is addressed Multiple permits required 	<ul style="list-style-type: none"> Replaces most vulnerable portions of the trestle Recurring permits for small projects to maintain existing facilities 	<ul style="list-style-type: none"> Provides a vital link between shore and vessels Requires Corp permit, HPA, and Building Permit Potential impact to negotiations with tribes 	<ul style="list-style-type: none"> Addresses most risk factors Full funding may not be available Requires Corp permit, HPA, and Building Permit
Maintenance & Operations	<ul style="list-style-type: none"> Increasing yearly maintenance costs and more frequent inspection 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Increasing yearly maintenance costs and more frequent inspection 	<ul style="list-style-type: none"> Less ongoing maintenance costs Extends life of key elements 	<ul style="list-style-type: none"> Highly reduced ongoing maintenance costs Extends life of key elements
Construction	<ul style="list-style-type: none"> No immediate impact Small recurring maintenance contracts for critical areas 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Small construction contracts scheduled for issues 5 total phases over 25 year period Unique construction methods required 	<ul style="list-style-type: none"> Contract and duration 2-3 years Straightforward construction methods Several phases required 	<ul style="list-style-type: none"> Contract and duration 3-4 years Straightforward construction methods Several phases required

Note: Project elements are further defined in Section 5.0.

1.02 Project Recommendations

From an overall programmatic perspective of looking at the timber structures that support and provide a basic infrastructure to access the ferry system, the Partial Replacement Alternative is recommended as the preferred alternative to move forward in the next phases of design and construction. This recommendation considers the limited State funding in the current and future biennium for WSF as part of WSDOT in supporting a fiscally responsible option that provides less risk of failure or loss of function as a primary transportation facility for Vashon Island. Ideally, the lower risk, but higher cost to continue with a full replacement would be a prudent recommendation. Furthermore, a Partial Replacement is a deferral of the remaining components of a Full Replacement until additional funds are available/forecasted for preservation projects. The value of this study lies not in the determination of a total cost of a project alternative, but in the comparison of life cycle costs of project alternatives over a 30-year period and determining which alternative provides the best value per dollar spent when considering all relevant factors including risks

Key reasons supporting this recommendation and that are discussed in further detail in the pre-design study (PDS) include:

- Limited available funding/revenue to support a full replacement of VTRP estimated to cost \$43.2M in the next biennium
- Limited funding for replacement of other WSF timber trestles that are seismically vulnerable and also reaching an end to their service life
- Alternative 3 (the preferred alternative) will provide a minimal width structure meeting current seismic codes for a 975-year event while meeting a critical need to maintain service
- The option supports and provides infrastructure for a full trestle replacement when more revenue/funds become available in the future
- Partial realization of environmental benefits by reducing the number of creosote treated timbers in the water and stormwater treatment
- Comply with ADA accessibility standards
- Vashon Island is a logistically unique community dependent on WSF for surface transportation due to lack of a bridge or land/water connection; without ferry service following a seismic event, business and community impacts would be substantial
- Less maintenance costs and risks than alternatives for a No-Build or Rehabilitation
- Remaining timber section receives seismic bracing from the new structure
- Gives flexibility to location of a new terminal building or relocating the existing building

The scope for the Partial Replacement Alternative or “Vital Link” Alternative is to replace the western and northern sections of the trestle towards an objective to have a functional lifeline available following a seismic event. The scope includes:

- Demolishing and rebuilding exit lanes 1 and 2, including removal of existing creosoted timber piles, installing new concrete piles, new concrete trestle and deck
- New, wider pedestrian access
- Replacement of the bulkhead/seawall
- New terminal building
- New utility (water, sewer, electrical) corridor along the western edge
- New fire protection system
- New storm drainage and treatment system

Issues and risks that will require close monitoring include availability of funding for timber trestle preservation projects, additional requirements if federal funds are added, Endangered Species Act (ESA) compliance with existing habitat, construction permitting constraints limiting in-water work, impacts to residents and businesses during construction due to ferry schedule revisions and ADA compliance/approval.

WSF Terminal Engineering will manage the Vashon Trestle Replacement project and design will be by a team of WSF engineers and consultants. The project contract is currently planned to be a design-bid-build project scheduled for AD in April 2014.

1.03 Program Analysis

The footprint of the trestle for the Vital Link alternative will remain essentially the same, creating either no increase or marginal increase in overwater coverage. Space requirements for a new terminal building will be determined as part of a facility program during design using existing draft facilities documents that account for current operational needs, waiting room and staff area needs, meeting current ADA and IBC and local code requirements, and terminal storage needs. A new building would also meet the design and construction requirements of the LEED Silver Certification in accordance with RCW 39.35D High-performance Public Buildings.

1.04 Site Analysis

The Vital Link alternative will be built in essentially the same location or footprint of the existing timber trestle; therefore, no additional Right of Way is required. Based on preliminary scoping, environmental impacts are expected to be minimal; however, lesser benefits than the complete replacement will need to be negotiated with the tribes. We anticipate, following a thorough review of a completed environmental checklist, issuance of a SEPA threshold determination of non-significance (DNS). In-water construction triggers the need for the following permits:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification (Ecology)

- Incidental Harassment Authorization (NOAA)

The COE permit also triggers compliance with the National Environment Policy Act (NEPA), as such compliance with Section 7 under the Endangered Species Act (ESA) and compliance with Section 106 under the National Historic Preservation Act will need to be documented. A building permit from King County will be needed for any impacts or modifications to the existing terminal building.

1.05 Project Budget Analysis

A portion of expenditures are not within the year of estimate (YOE). The budget values and their allocation by biennium periods is expected to change.

The project list detail supporting the 2011 supplemental budget identifies a total of \$41,024,000 available for this project. The preferred alternative capital cost estimate is \$31.8M.

1.06 Master Plan and Policy Coordination

The Vital Link alternative for the project supports the goals of the Agency defined in the WSDOT Ferries Division Final Long-Range Plan published in June 2009.

1.07 Facility Operations and Maintenance Requirements

The Vital Link alternative as scoped does not create a need for additional full-time employees. The project supports the Agency's commitment to act responsibly concerning the natural environment. Construction impacts to terminal operations will need to be minimized.

1.08 Other Considerations

Safety

The design of the Vital Link alternative will provide for increased safety of passengers that access the terminal building and King County passenger ferry. It also provides additional safety for inspection and maintenance of new utilities by WSF personnel.

Reliability/Service

The Vital Link alternative will provide an essential transportation connection for businesses, emergency services and island residents following a seismic event that could damage and disrupt service from the only other transportation link at the south end of the island at the Tahlequah terminal.

2.0 PURPOSE AND NEED

2.01 Agency Contact Information

Agency Name: Washington State Department of Transportation Ferries Division

Agency Code: 405

Project Title: Vashon Trestle Replacement

Agency Contact: Mark Anderson, P.E, Design Engineering Manager
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Project Identifiers: PIN:
WIN: M05204A
C to G: 10W221

Work Orders: XL3493

2.02 WSF Mission

The Washington State Department of Transportation (WSDOT) assigns to WSF the mission of providing marine high-capacity transportation linkages for people and goods throughout the Greater Puget Sound Region and Vancouver Island. WSDOT makes capital investments in the ferry system through the WSF Construction Program. The program's mission is to provide an infrastructure that maximizes the ferry system's ability to work reliably and responsibly for its customers. It accomplishes this mission by preserving existing and building new ferry terminals and vessels. This infrastructure gives the ferry system the physical capability to deliver transportation services to customers.

WSF is the nation's largest ferry system serving more than 22 million riders and more than 10 million vehicles each year. The Fauntleroy/Vashon/Southworth route connects Fauntleroy (approximately 8 miles south of Seattle), Vashon (on the northern end of Vashon Island) and Southworth (located on the Kitsap Peninsula). This run is a main route providing connections both from south Kitsap County via Southworth and from Vashon Island to the greater Seattle metropolitan area.

2.03 Project Purpose

The purpose of the Vashon Timber Trestle & Terminal Replacement Project is to provide safe, reliable, and efficient service and connections for general-purpose transportation, transit, high-

occupancy vehicles (HOVs), pedestrians, and bicyclists traveling between Vashon Island, the Kitsap Peninsula, and the West Seattle metropolitan area and beyond. The project is intended to comply with current codes and standards.

The project should be fiscally responsible and supportive of state, regional, and local transportation plans, including, but not limited to, the *Washington State Department of Transportation Ferries Division Final Long-Range Plan: 2009–2030* (WSDOT 2009), as well as regional and local land use plans. The project should also be sensitive to the cultural and environmental resources of the vicinity in a manner that respects and enhances these resources.

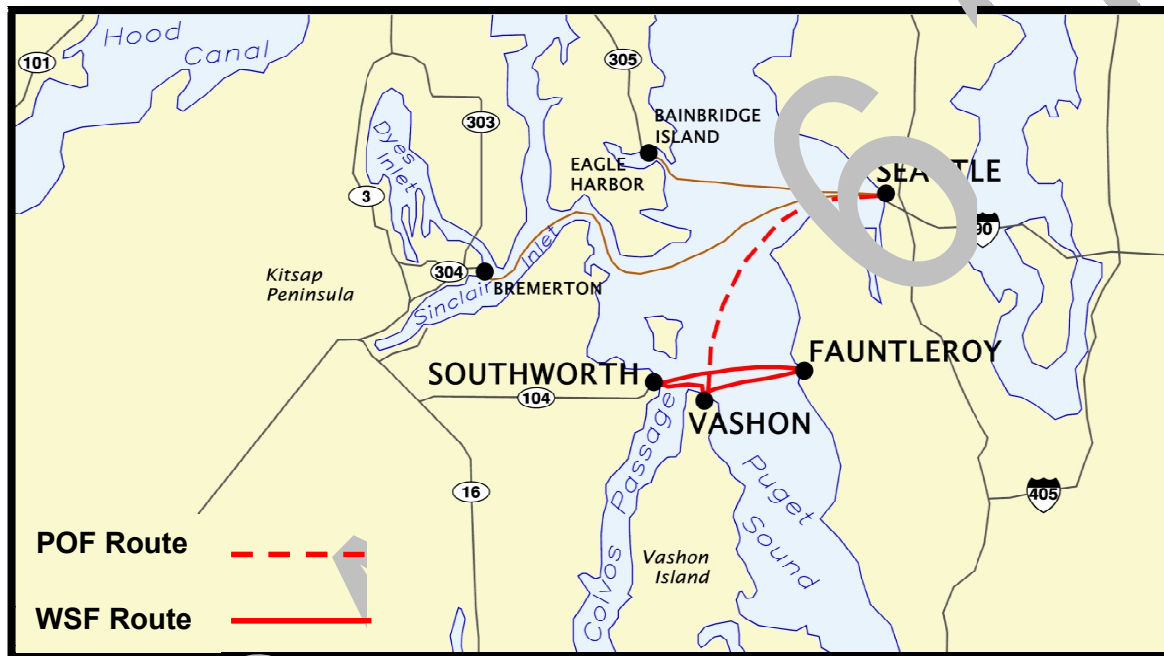


Figure 1: Fauntleroy/Vashon/Southworth Route Map

2.04 Site Description and Program Analysis

Vashon Island has a population of approximately 10,000 residents. WSF provides ferry service for vehicles and passengers traveling from Vashon Island at two terminals. The Vashon ferry terminal located at the north end of the island provides island residents over 20,000 vessel departures per year off the island to West Seattle, downtown Seattle, and to Kitsap County/peninsula at the Southworth Terminal. Vashon Island has been served by passenger and vehicle ferry service from the early days of the Seattle Mosquito Fleet. King County opened the first terminal on Vashon Island at Vashon Heights in 1919. Other ferries at Vashon/Maury Island preceded this terminal but not at Vashon Heights. Since 1951, WSF has provided ferry service for vehicles and passengers traveling from Vashon Island at two terminals.

The Vashon Island Ferry Terminal, on the north end of the island, services passengers traveling to the Fauntleroy Terminal in West Seattle and the Southworth Terminal in Kitsap County. The Tahlequah Ferry Terminal, on the south end of the island, services passengers traveling to the Point Defiance Terminal in Tacoma.

Fare collection at both the Vashon and Tahlequah facilities ended many years ago. Auto tollbooths and all money handling spaces (i.e. safe rooms) are therefore not required as part of the VTRP; however, replacement alternatives provide the opportunity to address existing fare collection operations at the Vashon Terminal.

The following vessels currently serve the Fauntleroy/Vashon/Southworth route with respective vehicle capacities:

- M/V Issaquah (Issaquah Class) - 124 vehicles,
- M/V Tillicum and M/V Klahowya (Evergreen State Class) – 87 vehicles each

The alternative for accessing the island is to take the ferry from Point Defiance in Tacoma, to the Tahlequah Ferry Terminal located at the south end of Vashon Island. The Tahlequah terminal, constructed in 1958, has one slip and is currently served by one vessel, the M/V Chetzmoka (Kwa-di Tabil Class), with a capacity of 64 vehicles. The largest size vessel that can serve the Point Defiance and Tahlequah terminals is the M/V Sealth (Issaquah Class) with a capacity of 90 vehicles.

Between June 1951 and July 2009, WSF also operated a passenger-only service on SR339, an 8.5 nautical-mile ferry route from Vashon Island to downtown Seattle at Pier 50. Currently, the King County Ferry District (KCFD) operates the passenger-only ferry (POF) service and leases the slip and trestle facilities from the state, see Figure 1. The passenger only service operates weekdays with three morning departures from the Vashon terminal to Seattle and three evening departures to Vashon. Current capacity of the vessel on the route is 150 passengers.

The existing terminal has a bulkhead/seawall and timber trestle that is approximately 800-feet long, 67-feet wide, and was originally constructed in 1957 with creosote treated timbers. The design of the original trestle structure provided for a structural life of 40 years, which resulted in the structure needing replacement in 1997. However, WSF increased the service life for this and similar timber trestles by 12 years based on annual condition assessments by the WSDOT Bridge and Structures Office. This update reset the year due for replacement to 2009, which has now passed. The timber structures are now 55 years old and three years past due for replacement. In addition, approximately 20% of the wooden piles supporting the trestle have deteriorated and been replaced with stub piles. Furthermore, components of the trestle are becoming increasingly vulnerable to major damage following a catastrophic seismic 72-year event and do not meet ADA requirements or current WSF design standards.

Route Information

Ferries provide vital surface transportation links between Vashon Island and the surrounding areas. The Vashon Terminal serves as a critical highway connection between King County and Kitsap County. Vashon Island has local bus service on the island including service to Seattle provided by King County Metro Transit (Routes 118 and 119). These metro routes travel from the Vashon Island Terminal to the Fauntleroy Terminal in West Seattle.

Vashon and Maury Islands are served by two ferry terminals: the Vashon ferry terminal at the north end and the Tahlequah ferry terminal at the south end of Vashon Island. The Vashon terminal has the highest volume of passengers and vehicles of the two terminals.

The WSF ferry service at these two terminals is the only public transportation link for vehicles to the mainland for Vashon Island and has been identified in the Long-Range Plan as an essential connection that the community depends on as the only means to transport goods – including basic supplies and local products – to and from the wider market.

WSF categorizes the Vashon Island Terminal as a “Commuter Terminal,” meaning that the terminal is generally busy year-round and exhibits minimal increases in tourist traffic flow during the summer months. In 2010, nearly two million passengers traveled between Fauntleroy and Vashon and approximately 160,000 passengers traveled between Southworth and Vashon (Source: WSF Traffic Statistics Rider Segment Report, 2011)

2.05 History and Background

The Vashon terminal was built in 1957 with one slip and was later expanded to include a bus turn-around area in 1974. Construction of a second operating slip and tie-up slip occurred in 1975. The terminal building was first modified in 1982. The passenger-only facility was built in 1988, and the trestle was resurfaced in 1990. The towers, transfer spans, and bridge seats were replaced for both the main and auxiliary slips in the mid-1990s. The main slip timber wingwalls were replaced with steel in 1996. The main slip timber dolphins, originally built in 1990 and 1989 were replaced with steel in 2009. A new steel dolphin was also added to the auxiliary slip in 2009 under the same construction contract. The auxiliary slip and the tie-up slip share two double-sided steel dolphins, built in 1996 and 2002. The second operating slip had one additional steel dolphin built in 1997, and the tie-up slip had a timber dolphin and a composite dolphin built in 1979 and 1992, respectively. The auxiliary (east) slip and wingwalls were replaced in 1993, and the main (west) slip was replaced in 1997.

A recent maintenance project in 2010 included an asphalt overlay of a portion the trestle; repairs to damaged decking, stringers, and pile caps underneath the asphalt; and added replacement piling for some severely deteriorated piling. The maintenance project's goal was to keep the trestle functioning for another five or six years until it is replaced by the VTRP. Items identified for repair and replacement are based on recent inspections. Many of the deteriorating items were left in place on the assumption that the trestle is scheduled for full replacement.

These recent projects exemplify the ongoing and increasing need for significant maintenance at the Vashon Terminal. WSDOT's Life Cycle Cost Model (LCCM) lists the facility components due for replacement between 2013 and 2031 that are in addition to these ongoing maintenance needs. These elements are listed in Table 9 of Section 4.0.

Site Layout & Terminal Use

The terminal, shown in Figure 2, consists of a large timber trestle used for vehicle holding and is supported by a large number of creosote and pressure-treated wooden piles arranged in bents. The piling support additional structural members (e.g. pile caps, stringers and decking) and an asphalt surface on the car deck.

Currently, the Vashon ferry terminal operates a 3-boat schedule to Fauntleroy in West Seattle and to Southworth on the Kitsap Peninsula. King County uses the passenger-only ferry (POF) slip at the northwest end of the trestle to transport walk-on passengers directly to downtown Seattle. King County Metro and Vashon Island school buses regularly meet students commuting to Vashon by driving onto the trestle. The terminal operates 22 hours per day.

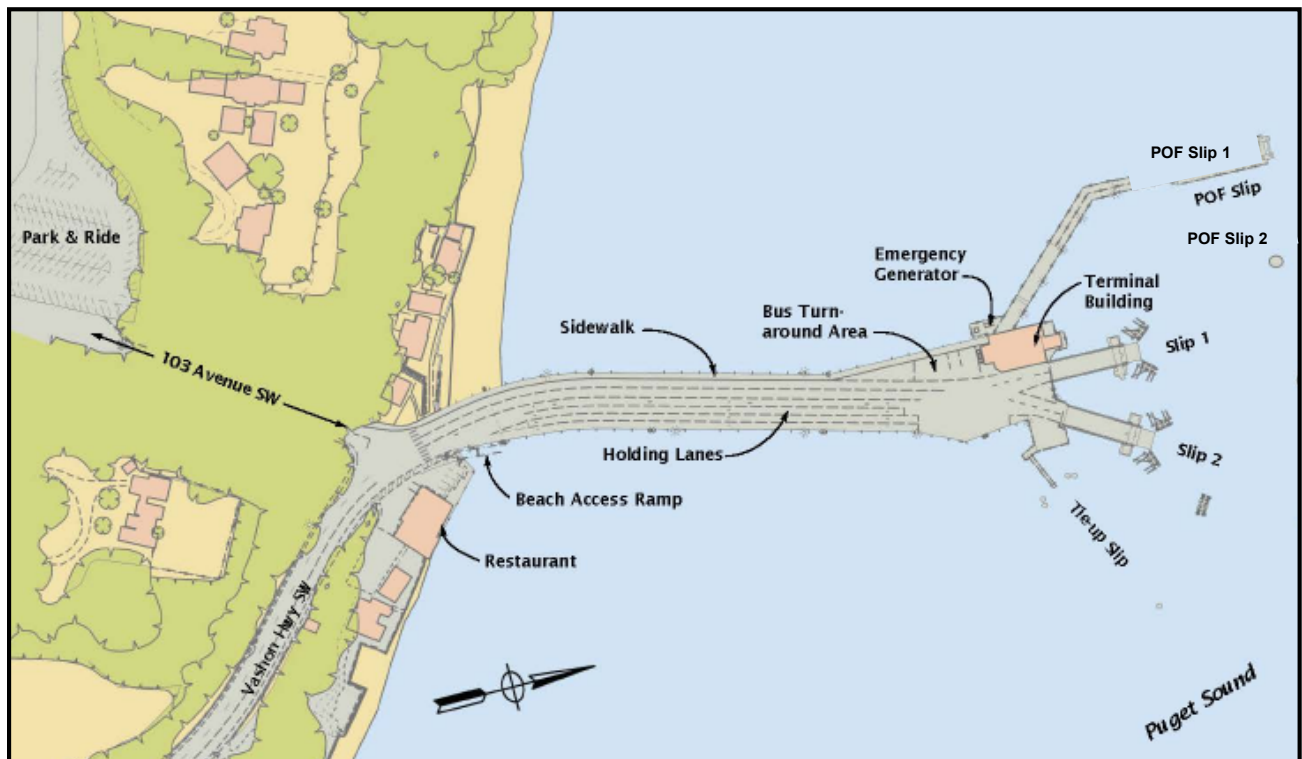


Figure 2: Vashon Ferry Terminal Overall Site Plan

Source: WSDOT Ferries Division Route Reference Manual, June 2006

The trestle provides a connection between the upland areas and the five vessel slips (two main operating slips, one tie-up slip, and two passenger-only-ferry slips). The trestle also provides a majority of the vehicle holding area, approximately 80 vehicles, where vehicles temporarily park while waiting to board the vessel. The holding lanes located on the trestle are arranged in such a fashion to facilitate sailings to two destinations. This operational consideration will be a concern for traffic management during construction. The remainder of vehicle holding is along Vashon Highway, as shown in Appendix B.

The amount of time vehicles wait on the trestle is dependent on ferry headways (amount of time between vessel sailings). The range of headways for vessels sailing from Vashon is 15 minutes to 1 hour and 40 minutes for Fauntleroy and 20 minutes to 2 hours for Southworth. Assuming a vehicle is able to board the next sailing, the longest a vehicle would be parked in the holding areas is 2 hours. The sailings begin at 4:05 am and the terminal continues operating until 2:40 am (Source WSF Sailing Schedule Spring 2012).

2.06 Site Analysis

The goal of the Pre-Design Study is to analyze alternatives that meet the project purpose. This study looks at three alternatives that address the purpose and two alternatives that do not. Today's current seismic code requires designers to meet the 975-year event. For purposes of allowing a like comparison of all alternatives in an Asset Management Analysis (section 4.03), a 975-year event was used.

Early in the Pre-Design Study analysis, a seismic assessment of the trestle was conducted with the assistance of the WSDOT Geotechnical Division and structural engineers from the consulting firm of Moffatt & Nichol. The initial seismic study determined that the outer-most third of the trestle was at risk of collapse during a 72-year seismic event; the portion of trestle supporting the terminal building being slightly more vulnerable than the adjacent outer-most trestle. The study also determined that the near-shore third of the trestle, comprised of numerous stub piles was the next most vulnerable section of trestle. The analysis estimated that this near-shore section would fail during the 100-year seismic event. The study also concluded that the middle third of the trestle was the most likely portion to withstand significant damage from an earthquake; seismic analysis determined that it can meet the 400-year event. Refer to the preliminary geotechnical report referenced in Appendix A, for more information regarding the seismic vulnerability of the trestle.

The Seattle Fault is a zone of multiple, shallow, east-west thrust faults that cross the Puget Sound Lowland and passes through Seattle in the vicinity of Interstate 90. The Seattle Fault is considered a significant seismic hazard and has been shown to be part of a regional system of faults.

The Seattle Fault (and the related Tacoma Fault) is not the only source of earthquake hazard in the Puget Lowland. Other faults in the near surface continental crust are suspected of generating earthquakes of near magnitude 7. However, the Seattle and Tacoma faults are probably the most serious earthquake threat to the populous Seattle-Tacoma area. A 2002 study of bridge vulnerability estimates that a magnitude 7 earthquake on the Seattle Fault would damage approximately 80 bridges in the Seattle-Tacoma area.

Recent significant earthquakes occurred in the same general region on February 28, 2001, the Nisqually earthquake, (magnitude 6.8 Moment Magnitude Scale (MMS)), April 29, 1965 (magnitude 6.5 MMS) and April 13, 1949 (magnitude 7.1 MMS).

2.07 Operational Needs

Below is a summary of the areas and their functions provided by the existing terminal facility. For information on the location of these areas, refer to the site plans contained in Appendix B.

Accessibility

Two ADA passenger studies have been previously completed for WSF, which provide accessibility recommendations on a terminal-by-terminal basis. During the PS&E phase of the VTRP, an additional deficiency survey will be performed. The Vashon terminal provides two ADA parking stalls located near the terminal building for the convenience of passengers traveling with disabilities. These passengers are able to leave their vehicles for up to 7 hours.

On the west side of the exit lanes is a pedestrian access way, which provides pedestrian access from Vashon Highway to the terminal building and the passenger only ferry service. The pedestrian access way is separated from the exit lanes by a curb, which is approximately four inches wide and 6 inches high. There is a utility corridor that runs along the railing in the access way and intrudes into the clear width. The Table 3 summarizes the clear width of the walkway by bent location compared to the current standards for ADA accessibility.

Table 3: Existing Walkway Width

Location	Existing Clear Width	Current Standard
Bent 1 to Bent 27.5	4'-0"	5'-0"
Bent 27.5 to Bent 35.5	4'-7"	5'-0"
Note: The current standards for accessible paths are contained in the WSF Terminal Design Manual, May 2012		

In addition to the ADA clear width requirements for the walkway, an accessible path to all other public areas of the terminal will be required based on current ADA regulations. This information and additional ADA requirements will be verified during the PS&E stage of the VTRP.

Vehicle Holding

The trestle provides vehicle holding in four lanes. Table 4 summarizes the widths of the existing holding lanes compared to the current standard width. WAC 468-300-700 gives preferential loading privileges to certain exempt vehicles such as emergency vehicles, school vehicles, and ride-sharing vehicles, amongst others. One such lane is provided for preferential holding on the trestle (Holding Lane 4).

Table 4: Existing Holding Lanes

Lane	Existing Width	Current Standard
Holding Lane 1	9'-3 ½"	9' Minimum
Holding Lane 2	8'-9 ½"	9' Minimum
Holding Lane 3	8'-3 ½"	9' Minimum
Holding Lane 4 (Preferential)	10'-5"	11' Minimum
Note: The current standard for holding lane widths is contained in the WSF Terminal Design Manual, May 2012		

Exit Lanes

WSF typically provides two offloading lanes on the trestle for vehicles exiting the terminal. The designated speed limit for the exit lanes at Vashon is 20 mph. The Table 5 summarizes the widths of the existing exit lanes compared to the current standards.

Table 5: Existing Exit Lanes

LANE	EXISTING WIDTH	Current Standard
Exit Lane 1	10'-2"	11' Minimum
Exit Lane 2	10'-7 ½"	11' Minimum
Note: The current standard for exit lane widths is contained in the WSF Terminal Design Manual, May 2012		

Vehicle/ Transit Turnaround

The existing terminal provides a vehicle turn-around area at the northern end of the trestle, near the vessel slips. Commercial vehicles, metro busses, and school busses use this area.

Southworth-bound trucks execute multiple turns on the trestle in this area and back on the ferry. Existing bus service enters the trestle via the diamond lane or an exit lane, and performs a turnaround at the end of the trestle. Some buses execute a multiple turn rather than a U-turn. The existing trestle provides sufficient space to allow for a standard U-turn; however, vehicles parked in non-designated areas often encumber the space. School buses drop off as many as 180 students on weekdays around 7am to board the vessels

Tie-Up Slip and Gangway Ramp

There is one tie-up slip accessed by a pedestrian gangway to the northeast of the trestle. WSF uses this slip to moor vessels overnight.

Signage

There are two sign bridges over the trestle, which direct vehicles in the holding and exit lanes.

Terminal Building

The 2,900 square foot terminal building provides an inside and a covered outside waiting area for WSF and King County passengers. The building also provides restrooms, water fountains, and vending for customers.

Vashon Ferry Terminal employs seven WSF personnel. The terminal building provides office space for these employees. Currently, amenities for WSF employees on the site are limited and employees share the same restrooms as passengers. Minimal staff parking is provided on the trestle; currently, three spaces are dedicated for maintenance vehicles. WSF staff park offsite or in non-designated areas.

The terminal building provides areas to store janitorial and office supplies. This area is combined with the employee break room and is undersized.

Enclosed storage is provided on the trestle for vessel lines and supplies, vessel ropes, flammable materials, deck operation supplies, oil containment supplies, traffic cones and signs, as well as the Eagle Harbor Maintenance crew's supplies. Additional outside storage space is provided for operational equipment (a man lift and a dock bull).

A covered bicycle storage rack for eight bicycles is provided at the terminal building. The utilization of this area is unknown; however, providing a terminal building with more appropriate amenities may increase the demand for bicycle storage.

2.08 Space Requirements

As this is a preservation project, it is not anticipated that the trestle will increase in size significantly, no more than two feet in additional width. Issues that could result with an increase to the existing footprint are:

1. The current pedestrian walkway width which is undersized at 4-feet needs to, at a minimum, meet current standards,
2. The lane widths which do not meet current standards,
3. The terminal building which is anticipated to be approximately 20% larger in order to meet current design standards and,
4. The bus turn around area.

Any increase in the trestle's footprint would likely be offset by reducing trestle area elsewhere on the trestle. This can be achieved by reducing or removing unused or non-essential areas. The ultimate goal is no net increase in overwater coverage.

2.09 Future Requirements

Vehicle Reservation System

WSF has researched implementing a vehicle reservation system at all of its terminals. Such a system is not feasible at this time and would require significant improvements at Vashon Island. The facility does not collect fares for passengers traveling from the island so the system would be a great cost to WSF. The terminal does not have tollbooths or the infrastructure to support a reservation system. Also, the terminal has short time durations between vessel sailings, which would complicate vehicle processing. As this system is not foreseen to be implemented at the Vashon terminal, this element does not affect the selection of the preferred alternative.

Hydraulic Vehicle Transfer Span

The current terminal uses mechanical vehicle transfer spans, cables and pulleys. Additionally, the two existing transfer pans use two different versions of the cable hoist system; one of which is an older version with non-standard controls. Recent WSF projects at other terminals have replaced the mechanical vehicle transfer spans with hydraulic vehicle transfer spans (H-Spans). The current 16-year plan does not call for transfer span replacements at the Vashon terminal; however, H-spans may be required at a future date. The incorporation of H-spans could be accommodated in the design of a full or partially replaced trestle with minimal cost increases (i.e. running additional electrical conduit for future demands).

Vessels

Future plans for the Vashon terminal (as described in the WSF Final Long Range Plan) include replacing one of the two 87-car Evergreen Class vessels with a 124-car vessel by 2015. Additionally, by 2030, the terminal will operate three 124-car vessels during fall, winter, and spring, two 124-car, and one 90-car vessel during the summer schedule. The future vessel accommodations will not be impacted by any of the considered alternatives.

2.10 Project Analysis

Project Limits

The limits to this project begin on the south end of the trestle at Bent -1.5 (approximately 25 feet behind the bulkhead/seawall) and end on the north end at Bent 43.5 at the edge of the trestle by the terminal building. Additionally, an upland parking area is part of the project limits to be used for parking and staging operations during construction.

The project does not include any work to the operating slips, tie-up slip, passenger-only ferry service, concrete bridge seats, or the emergency generator and its concrete foundation. The project will address the Beach Access Ramp that is adjacent to the southeastern edge of the trestle near the bulkhead/seawall. The project will remove and replace the sanitary pump tank and holding station to the north of the trestle.

The main terminal building was constructed in 1957 and renovated in 1983. The 40-year service life from the time of the renovation will be up in 2023. Despite having a remaining service life of over ten years, the terminal building is located entirely on the trestle and therefore should be considered for replacement concurrent with any structural work impacting the building. Alternatively, the existing building could be relocated onto the replaced portion of the trestle.

Replacement of the trestle will most likely require reducing service and converting to a 2-boat schedule during construction. Drivers will not be allowed to drop-off passengers and/or turn around on the trestle during construction. WSF estimates that construction will take two to three construction seasons to replace or partially replace the trestle.

2.11 Stakeholders & Tribes

The VTRP will affect many island residents and businesses as the Vashon terminal at the north end of the island has two main slips and runs on a 3-boat schedule. The ferry terminal to the south, Tahlequah, has one slip and runs on a 1-boat schedule. Annual 2011 WSF ridership for the terminals is 1.67M vehicles, 1.25M passengers; and 0.37M vehicles, 0.27M passengers respectively. Annual 2011 King County ridership for the Vashon terminal is 0.17M passengers. The economy of Vashon Island relies on residents commuting to Seattle and Tacoma and the ferries for deliveries of goods and services to local businesses.

Currently, Pacific Research Laboratories is the largest manufacturer on the island. Other users of the Vashon terminal include daily commuters to McMurry Middle School and Vashon High School from West Seattle and Kitsap County, construction companies, medical and commerce related businesses. The community is also dependent on deliveries to the local supermarket, Thriftway, one gas station, and a large True Value Hardware store. The U.S. Post office, King County Wastewater, and King County Water District are also key agencies with facilities dependent on using the ferry terminal.

The Puyallup Tribes have “Usual and Accustomed” treaty rights at Vashon, and the Mukilteo Tribe has recently purchased property on the island and has requested updates on the trestle replacement project.

Stakeholders List:

- King County Ferry Passenger-Only Service
- King County Metro
- Vessel Captains
- WSF Operations Constructability Review by WSDOT
- Utilities providing temporary and/or permanent service
- Local Fire Marshall
- Vashon Island School District
- Law Enforcement
- King County Solid Waste Division
- First Student, Inc
- Vashon Maury Island Chamber of Commerce

2.12 Master Plan and Policy Coordination

The project will support the goals of the Agency defined in the WSDOT Ferries Division Final Long-Range Plan published in June 2009.

2.13 Codes and Regulations

Applicable Codes – Structural

- AASHTO LFRD Bridge Design Specifications, Current Edition
- AASHTO Guide Specifications for LRFD Seismic Bridge Design, Current Edition
- WSDOT Bridge Design Manual, Current Edition
- AISC Manual of Steel Construction, Current Edition
- American Concrete Institute (ACI) 318-05, Current Edition

Applicable Codes – Electrical

- National Electrical Code (NEC), Current Edition
- Applicable Codes – Architectural
- International Building Code (IBC), Current Edition
- American Concrete Institute (ACI) 318-05, Current Edition
- AISC Manual of Steel Construction, Current Edition
- King County Building Code
- Washington State Energy Code
- RCW 39.35D High-performance Public Buildings - LEED Silver Certification

Accessibility Regulations

- Americans with Disabilities Act (ADA), 1990
- Revised Draft Passenger Vessel Accessibility Guidelines and Supplementary Information, 2006

Environmental Regulations

- Endangered Species Act (ESA)
- Marine Mammal Protection Act (MMPA)
- National Environmental Policy Act (NEPA)
- Washington State Environmental Policy Act (SEPA)
- Clean Air Act of 1991
- Water Quality Implementation Agreement (WQIA)
- Coastal Zone Management (CZM)
- National Pollutant Discharge Elimination System (NPDES)
- King County Shoreline Master Program
- Washington State Department of Archeology and Historic Preservation – Section 106 Concurrence
- Growth Management Act of 1990

Security Regulations

- Code of Federal Regulations, 33CFR105 (Marine Security: Facilities)

2.14 Design Constraints

Constructability

Construction of the Vital Link alternative will maintain functional use of the terminal during the full-course of construction. This includes keeping the existing terminal building operational until a new building is constructed.

3.0 ALTERNATIVES ANALYSIS

Five alternatives were developed for evaluation that meet the operating needs for the terminal. In developing these alternatives, it was important to evaluate the alternatives on two time scales for budgetary purposes. A 75-year service life span was used for each alternative so that full life cycle costs are comparable; however, a 30-year period was considered so that a social discount rate could be applied to risks along with the benefits vs. cost analysis. A more detailed discussion of the budget analysis is contained in Section 4.0 of this Pre-Design Study.

Alternative 1 – No-Build, was evaluated as part of this study as a baseline. It includes continued and increased maintenance requirements for 75 years into the future. This would only be selected if authorization is not given for the selected alternative.

Alternative 2A – Seismic Bracing, consists of reducing the risk of a trestle structural failure in the event of an earthquake by constructing seismic braces every third bent that will seismically upgrade the trestle to meet the 975-year event. This alternative does not address the functionality of the Vashon trestle, nor does it replace any of the existing structural or civil components (bulkhead, bents, utilities, etc.) This alternative results in a slight increase in overwater coverage and additional piles driven outside of the existing footprint. This alternative does not meet the project purpose and need.

Alternative 2B – Rehabilitation, consists of reducing the risk of a trestle structural failure in the event of an earthquake and an alternative means of supporting the trestle deck. This alternative constructs the seismic bracing proposed as part of Alternative 2A to upgrade the trestle to meet structural criteria for the 975-year event and provides an incremental approach to the existing structural and operational deficiencies of the trestle. This alternative does take advantage of opportunities to upgrade the functionality of the Vashon trestle over the next 25 years. This alternative considers the incremental costs to rehabilitate the trestle to increase the service life to 75-years. This alternative results in a slight increase in overwater coverage and additional piles driven outside of and underneath the existing footprint.

Alternative 3 – Partial Replacement (Vital Link), consists of replacing the west side and north end of the trestle. This alternative replaces a section of the trestle with a 75-year service life and upgrades the replaced portions of the trestle to meet the 975-year seismic event criteria as well as ADA and stormwater standards. Alternative 3 does not replace any of the four holding lanes on the trestle, however, it would maintain an essential transportation link that allows for the use of the trestle in the event of a catastrophic seismic event. This alternative may result in a slight increase in overwater coverage in order to meet current standards.

Alternative 4 – Full Replacement, consists of full replacement of the trestle and terminal building. Everything composed of creosote treated timbers is replaced, and the trestle would meet the 975-year seismic design requirements as well as addressing upgrades for ADA and stormwater standards. This alternative may result in a slight increase in overwater coverage in order to meet current standards. Alternative 4 may take an additional 4th year to construct.

Grade breaks in the middle of the trestle between the replaced exit lanes and non-replaced holding lanes are assumed and considered infeasible for the purposes of the Predesign Study. In other words, the phased replacement of the trestle is to honor the surface elevation of the

existing trestle during all phases at areas of interface. Although temporary grade breaks at certain areas of the trestle are probably acceptable for a short period of time (say 4 months maximum), the consideration of temporary grade breaks on an operating trestle will require a careful and detailed analysis during final design and for that reason is beyond the scope of this Predesign Study. This geometric constraint (vertical geometric design) is critical to each alternative, with the exception of the No-Build alternative and Alternative 2A, considered below.

3.01 Alternative 1 – No-Build

Overview

Alternative 1 is to defer major capital improvements indefinitely until authorization is received for another alternative. The No-Build alternative does not address any of the known deficiencies of the existing facility.

The scope of the No-Build alternative consists of continuing the annual inspection program of the numerous components that make up the terminal including the composite treated timber piling, pile caps, deck and asphalt surfacing, the terminal building and all utilities. Under this alternative the timber piling trestle foundation will eventually deteriorate due to infestation by marine shipworms (torritos and gribbles), see Figure 3. As components of the terminal fail inspection, they will be replaced or reinforced as needed to provide a short-term fix.

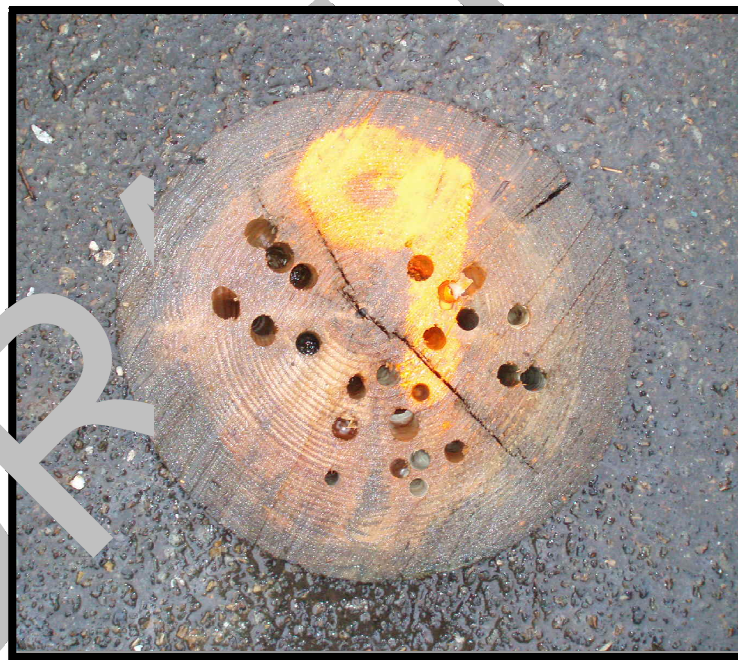


Figure 3: Shipworm Infestation at Vashon Terminal

Recently completed maintenance conducted at the Vashon terminal exemplifies the No-Build alternative. Maintenance contracts would include replacing pavement every six years, replacing structural elements such as timber piles, caps, and stringers as necessary, repairs to the bulkhead/seawall, and maintenance to the terminal building.

Major maintenance repair projects would occur approximately every 3-6 years on the 55-year old trestle, more frequently as the trestle continues to age. The cost of the most recent trestle preservation project was approximately \$1,000,000 in 2010. A similar project of this scale would be scheduled at approximately 6-year intervals. Recent maintenance and seismic retrofit projects are summarized in the table below. Additional maintenance is currently being deferred until it is determined if this project will move forward and what the scope would be.

Table 6: Recent Maintenance & Seismic Retrofit Projects

Project	Project Cost	Recurrence
Deck Repair, July 2009	XXXXXXXX	XXXXXXXX
Slip 1 Bridge Seat Seismic Retrofit, June 2010	\$110,000	
Trestle Preservation, Oct. 2010	\$1,000,000	3-6 years
Slip 2 Bridge Seat Seismic Retrofit, August 2011	\$110,000	

Trestle Structural

An initial seismic analysis of the Vashon trestle determined that the outer most section of trestle was at risk of collapse during a 72-year seismic event. Restoring partial service to the terminal, sufficient to have walk-on passengers reach the passenger-only slip, could take from 3-6 months. Restoring partial vehicular service to a main slip could take from 6-18 months. Full restoration, repairing and replacing damaged sections of the trestle, could take from 2-10 years. An asset management model assigned a cost to public delay, accounting for additional time needed to make trips via the ferry at Vashon, assuming service was available at Tahlequah.

The structural components of the trestle under the No-Build alternative will be “bandaged” with stub piles as increasing numbers of existing piles are red-tagged after failing inspection. While stub piles increase vertical support, they do not give significant lateral restraint which is required to reduce the risk of failure in the event of a seismic event.



Figure 4: Stub Piles at Vashon

In addition to stub piles being added to support the trestle, bents will be strengthened as needed by installation of steel brackets.



Figure 5: Steel Support Brackets at Vashon

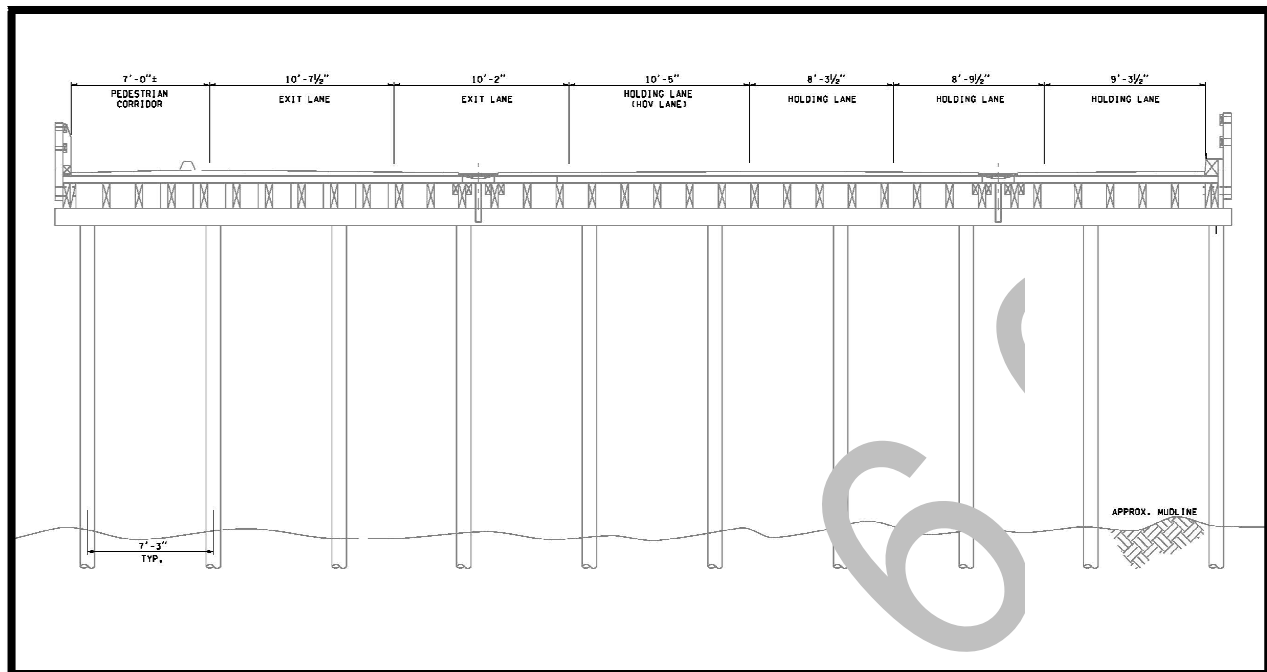


Figure 6: Existing Trestle Cross Section (Looking North)

Bulkhead/Seawall Structural

According to the 2011 Washington State Ferry Terminal Structural Inspection report, the concrete bulkhead/seawall serves no structural purpose. The bulkhead/seawall prevents access to bents 1 and 2, which are under the roadway. The Structural Inspection report does not inspect these buried bents as they are behind the bulkhead/seawall and access is limited. The No-Build alternative does not address the bulkhead/seawall and buried bents.

Terminal Building & Waterside Enclosures

The existing terminal building and waterside enclosures would not see any improvements under the no-build alternative. The existing facilities would continue to become dated over time and inadequately sized for the increasing ridership that is projected by the WSF Long Range Plan. Additionally, no improvements to the operational circulation routes for vehicles and pedestrians would be implemented resulting in continued fare collection issues with walk-ons traveling between Vashon and the other two terminals along the route. Currently, the terminal building does not meet seismic design criteria.

Pavement

In October 2010, the Terminal Engineering Maintenance Department administered a Timber Trestle Preservation project that included new asphalt throughout the exit lanes and adjacent to the slips. The cost of the Timber Trestle Preservation project was approximately \$1,000,000. The No-Build alternative would result in the Maintenance Department continuing to resurface areas of the trestle approximately every 6-years. Note that the east half of the trestle, resurfaced in 2010, will require resurfacing in 2016.

Utilities

The electrical system serving the terminal is adequate to serve the existing slips, trestle lighting and terminal building. The current 16-year plan does not call for transfer span replacements. The standard transfer span, a hydraulic span, consumes significantly more energy than the existing mechanical span. As a replacement is not currently scheduled, there is not a need to consider increasing the power source at the terminal. However, if the terminal switches over to hydraulic transfer spans, the electrical system will likely have to be upgraded at that time.

Therefore, with this alternative there are no additional costs to maintain or upgrade the existing electrical system. Any efforts to reduce power usage at the terminal will not be addressed in the No-Build alternative.

The mechanical system at Vashon is outdated and in need of replacement in addition to the vacuum sewer system that operates the sewage system. Portions of this system would be replaced or repaired on an as needed basis. Portable toilets could be used to replace the system or the restrooms could be closed. Alterations to the existing sewer system may result in additional regulatory requirements for upgrading and or retrofitting the sewer system on adjacent properties.

The fire line that serves the timber trestle as well as the terminal building would be replaced or repaired on an as needed basis. A fire department inspection will likely be the trigger for such a repair/replacement.

The potable water system serving the terminal would not be replaced even though it is dated and in need of replacement; it will most likely continue to serve the terminal with minimal maintenance and repair.

Currently, surface water drains through the trestle deck, untreated, into the Puget Sound. This amounts to approximately 60,000 sf of untreated surface water from the trestle. Additionally, surface water from Vashon Highway leading to the trestle flows onto it and enters the Puget Sound without any treatment. These conditions will remain unchanged with the No-Build alternative.

Signage

The two existing sign bridges and static signs located at the terminal would not be altered under this alternative. Figure 7 shows a portion of the existing sign bridge foundation at the Vashon Terminal.



Figure 7: Existing Sign Bridge Foundation at Vashon

Security

Security needs and requirements would continue to be addressed through operational revisions within the limits of the current facilities that could result in an impact to existing operations.

Environmental

Environmental concerns are not addressed with the No Build Alternative. Creosote piling will remain in place. Furthermore, in order to maintain the trestle structurally, additional stub piles will be added which increases benthic coverage. Stormwater from the trestle will continue to discharge into the Puget Sound untreated.

Maintenance and Operations

The associated maintenance and operations of this alternative would change very little. Additional maintenance will likely be necessary as the structure ages and deteriorates.

Cost

The estimated cost of this alternative over a 30-year period is \$-----. A detailed cost analysis and comparison is included in Section 4.0.

Permitting

There are no foreseen new permit requirements for this alternative. The maintenance projects that would be required would fall under existing WSF programmatic permits.

Risk

This alternative contains multiple risks including significant damage and/ or failure following a seismic event, tribal concerns, ADA compliance, and stormwater treatment. These risks are summarized here and explained in more detail in Section 5.0.

The seismic analysis determined that the Vashon trestle is highly vulnerable to damage following a seismic event; the furthest offshore portion of trestle could fail during a 72-year event. An event that closes the terminal would impact residents and limit access to the island to be from the ferry terminal to the south, Tahlequah, constraining customers destined for Seattle to travel via Point Defiance and Tacoma. It is highly likely that the Tahlequah terminal could be significantly damaged in the same event resulting in a loss of all surface transportation for an extended period until at least one terminal servicing Vashon Island is repaired.

Early consultation with the Puyallup Tribe described the replacement project as one which would remove the creosote treated timber trestle and replace it with one composed of significantly fewer concrete or steel piling, freeing up significant benthic environment and removing over 560 creosote treated pilings from the Puget Sound. The replacement project also proposed treating surface water from the proposed concrete trestle (approximately 60,000 sf) consistent with the Puget Sound Tribes and the Governor's goal to clean Puget Sound in an effort to improve salmon habitat. A No-Build alternative fails to address this environmental benefit.

The existing trestle does not meet current ADA standards. Specifically, the pedestrian access is as small as 4-feet wide. The No-Build alternative does not address ADA standards.

The Department of Ecology has concerns with stormwater treatment. The current trestle does not treat any stormwater runoff. Likewise, the road accessing the terminal, Vashon Highway, conveys its runoff onto the trestle and to Puget Sound untreated. The northbound lane of Vashon Highway serves as a vehicular holding lane. Lack of stormwater treatment will continue with the No-Build alternative.

Construction

This alternative will have construction related activities associated with on-going maintenance. Construction practices and methods will be similar to that performed currently.

Schedule

The alternative will have an on-going maintenance schedule with major maintenance approximately every 6 years.

3.02 Alternative 2A – Seismic Bracing

Overview

Alternative 2A constructs a system of seismic braces to support the trestle, which upgrades the seismic capacity to withstand the 975-year event. This alternative does not rehabilitate or replace any additional structural or civil components of the trestle. It is anticipated; however, that some utilities will require relocation in order to construct the seismic braces.

Trestle Structural

An initial seismic analysis of the Vashon trestle was performed as noted under the No-Build alternative. Because of this analysis, WSF developed a seismic retrofit solution/strategy that

addresses the 975-year event. This alternative leaves the timber trestle in an “as is” condition and constructs a supporting system (tripods) ‘around’ the trestle with long steel spans underneath the trestle. These spans are spaced approximately every three bents. The design includes some additional over-water coverage, added benthic coverage, does not treat surface water, leaves all creosote treated timbers in place and does not address existing ADA deficiencies or the purpose of this pre-design study. This alternative only addresses the seismic vulnerability of the trestle. Figure 8 shows a cross section of the proposed seismic bracing system.

The seismic bracing alternative defers expenditure of a significant amount of initial capital, however, the agency would concurrently schedule maintenance, annual terminal inspections, replace red-tagged or damaged piling and damaged portions of trestle approximately every 6 years with projects similar to the one described under the No-Build alternative.

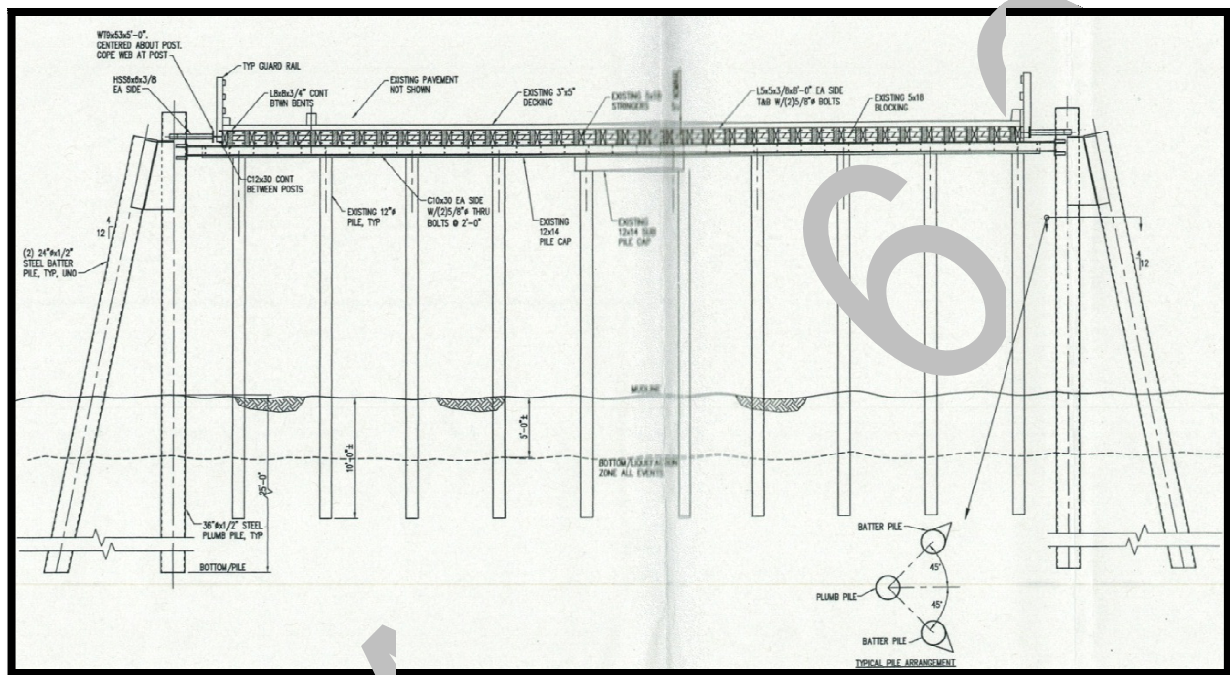


Figure 8: Alternative 2A Cross Section (Looking North)

The bulkhead/seawall is not replaced or modified under this alternative.

The seismic bracing alternative supports the terminal building foundation in the event of a seismic event. Additional changes will not be made to the terminal building under this alternative. This leaves the terminal building at risk of collapse in a seismic event, which will

effectively cripple operations at the terminal. If the building were to collapse, the electrical supply to the slips would be terminated and significant repairs would be required to make the building operational and activate the slips.

Pavement

The seismic bracing alternative maintains the current 6-year cycle in place for replacing asphalt pavement. The deck/pavement was last replaced along the west half of the trestle in 2010. Replacement of the eastern half pavement is scheduled for 2016.

Utilities

This alternative will not replace any existing utilities. It is anticipated that some utilities will require relocation in order to construct the proposed bracing system.

Signage

This alternative will not address any deficiencies in signage and wayfinding at the terminal including the sign bridge foundation.

Security

Security improvements are not planned with this alternative and would continue as currently in place.

Environmental

The planned seismic bracing of the trestle will increase the number of piling at the terminal. Additional pilings are required to create a tripod and cradle system as described above. This increase in additional piling will remove seafloor habitat for certain aquatic species and will slightly increase the amount of over water coverage resulting in additional shading.

Maintenance and Operations

Maintenance requirements for this alternative would occur on an approximate 5 to 10-year cycle. The seismic bracing components (cradles and seismic supports), would require maintenance at a higher level than a more traditional replacement project such as those described in Alternatives 3 & 4.

This alternative has a slightly higher level of required maintenance than the No-Build Alternative due to the increased number of structural components and due to the fact that the existing components are left in place. This alternative introduces an increased amount of steel structures in a less-than-ideal marine environment, further increasing maintenance requirements beyond what is currently required. WSF maintenance personnel have noted that this alternative presents complex and unfavorable maintenance requirements.

Operations would not require any additional personnel under this alternative. Construction phasing would need to take measures to provide continual operation of two slips and some holding lanes.

Cost

The estimated cost of this alternative is \$ 17.2M. This cost is in 2012 dollars and does not include required maintenance costs beyond the year of expenditure (YOE).

All alternatives apply a new asset management model approach to the business case that factors in such costs as delay impacts to customers due to the terminal being out of service or closed due to a seismic event. The business case assigns significant costs to the risk of a major seismic event interrupting ferry service for an extended period with loss of functional use of the trestle. This approach addresses some but not all of the risk factors.

The purpose of evaluating the seismic bracing alternative was to develop a method of safeguarding the trestle against the risk of a 975-year seismic event while not expending large amounts of capital.

Permitting

The required permits for this alternative will include:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification – Ecology
- Incidental Harassment Authorization (IHA) – NOAA
- Building Permit – King County

Risks

Similar to many projects at WSF Terminal Engineering, a design is developed that works from a structural and cost perspective. Proceeding to have such a project permitted or accepted from management, environmental staff and from our Tribal liaison is another issue or risk. Other metrics of value to the State in addition to structural integrity of the trestle need equal consideration. This alternative scored favorably from a structural and economic perspective; however, it presents significant risks. These risks, or in some cases opportunities, were evaluated and scored along with the other alternatives. These risks are covered briefly here and in more depth in Section 5.0 and Appendix H – Risk Matrix.

- Permitting
- Budget
- Tribes could oppose this option due to the increase in over water and benthic coverage
- Implementation of standards for vehicle lanes and ADA are indefinitely delayed

Construction

The construction assumptions include limited periods of in-water work over a 2 year duration. All phases of construction will require maintaining traffic accessibility to the slips and holding areas while the trestle is under construction. The design and construction phasing for the VTRP

will require extensive consideration of construction procedures in order to maintain operational conditions at the terminal.

Schedule

The alternative will require a phased schedule that will occur over the course of approximately 1-2 years.

3.03 Alternative 2B – Rehabilitation

Overview

Alternative 2B uses a phased approach over the course of approximately 25 years to replace all creosote treated piling and all 40 bents focusing on the most vulnerable bents first. The piling and bents are replaced in order of seismic vulnerability based on a recent seismic analysis of the trestle. This analysis divided the trestle into three seismic zones (see Figure 9: Alternative 2B Phasing). Zone 1 is the most shoreward and is the second most vulnerable to collapse in a seismic event. Zone 2 is the next offshore zone and is the least vulnerable. Zone 3 is the northern end of the trestle and is the most vulnerable to collapse due to liquefaction of sediments in which the piles are embedded.

Trestle Structural

An initial seismic analysis of the Vashon trestle was performed as noted under the No-Build alternative. As a result of this analysis the structural engineering division developed a seismic retrofit solution/strategy that addresses the 975-year event. The first phase of the design leaves the timber trestle in an “as is” condition and constructs a supporting system (tripods) ‘around’ the trestle with long steel spans underneath the trestle. This is the same work that is proposed as Alternative 2A – Seismic Bracing. These spans are spaced approximately every three bents. Replacement of existing bents starts in the first phase based on seismic vulnerability. The design includes some additional over-water coverage, added benthic coverage, leaves all creosote treated timbers in place for the short term, and does not address existing ADA deficiencies.

The rehabilitation alternative defers having to expend a significant amount of initial capital, however, there is a large amount of repeated work that’s needed on all phases such as mobilizations, traffic control and a disproportional amount of design budget associated with dividing a project into five pieces. Even though the rehabilitation alternative proposes postponing the expenditure of capital, the results are such that the estimate for this alternative is \$43.5M, more than the \$43.2M estimated for the full replacement alternative. However, the agency would concurrently schedule maintenance, annual terminal inspections, replace red-tagged or damaged piling and damaged portions of trestle approximately every 6 years with projects similar to the one described under the No-Build alternative. The cross section of this alternative is similar to that of Alternative 2A (see Figure 8).

Bulkhead/Seawall Structural

Construction of a new bulkhead/seawall takes place in Phase 1 of this alternative. The bulkhead/seawall is considered a vital piece of the trestle in order to withstand a seismic event and provide continued operation of the terminal.

Terminal Building & Waterside Enclosures

The rehabilitation alternative supports the terminal building foundation, the most vulnerable portion of the trestle in the event of a seismic event. Additional changes will not be made to the terminal building under the rehabilitation alternative. This leaves the terminal building at risk of collapse in a seismic event, which will effectively cripple operations at the terminal. If the building were to collapse, the electrical supply to the slips would be terminated and significant repairs would be required to make the building operational and activate the slips.

Pavement

The rehabilitation alternative maintains the current 6-year cycle in place for replacing asphalt pavement. The deck/pavement was last replaced along the west half of the trestle in 2010. Replacement of the eastern half pavement is scheduled for 2016.

Utilities

This alternative will replace the electrical system serving the terminal building and berthing structures. Additionally, this alternative replaces the fire, potable water, stormwater, and sewer systems throughout the trestle. Replacement of the utilities will be provided in order to avoid a piecemeal replacement of the utilities as this is an unfavorable practice.

This alternative does not trigger specific stormwater treatment requirements. Retrofit or replacement of the existing deck drains to provide treatment via media cartridges is potentially more feasible due to improved access to the structures at the time of construction. Since the deck drains are standalone structures and not part of an interconnected drain system, project phasing would be flexible to allow improvements to drainage. Additionally, in order to mitigate the risk of not receiving permits, the retrofit of deck drains to include media filtration cartridges is included as part of this alternative.

Signage

The rehabilitation alternative will seismically upgrade the sign bridge foundations. The foundations are connected to the timber piling of the trestle. The sign bridges would not be provided with any new or additional signage.

Security

Security improvements are not planned with the rehabilitation alternative and would continue as currently in place.

Environmental

The planned rehabilitation of the trestle will increase the number of piling at the terminal. Additional pilings are required to create a tripod and cradle system as described above. This increase in additional piling will remove seafloor habitat for certain aquatic species and will slightly increase the amount of over water coverage resulting in additional shading. The additional piling also inadvertently created an artificial habitat for other aquatic species including sea stars and anemones that attach themselves to the piling.

The rehabilitation alternative requires repeated work to describe the individually phased projects to various environmental review agencies. The environmental review process also requires multiple times WSF must reach out to the public, other stakeholders, and the tribes for each phase of the 25-year long project.

Maintenance and Operations

Maintenance requirements for this alternative would occur on an approximate 5 to 10-year cycle. Areas of the trestle that are pending replacement in later phases would require maintenance similar to existing levels in order to maintain an operable terminal. Areas of the trestle that are replaced in early phases, including cradles, micropiles, and seismic supports (tripods), would require maintenance. It is anticipated that the micropiles, cradle system, and seismic supports would include a higher degree of maintenance than a more traditional replacement project such as those described in Alternatives 3 & 4.

This alternative has a slightly lower level of required maintenance than the No-Build Alternative; however, this reduction will not be fully realized until after the entire project has been constructed. Furthermore, the design of this alternative introduces an increased amount of steel structures in a less-than-ideal marine environment, further increasing maintenance requirements. WSF maintenance personnel have noted that this alternative presents complex and unfavorable maintenance requirements.

Operations would not require any additional personnel under this alternative. Construction phasing would need to take measures to provide continual operation of two slips and some holding lanes.

Included in the list of repeated work is additional permitting and reaching out to stakeholders and Tribes for each phase of the 25-year long project.

Cost

The estimated cost of this alternative is \$ 43.5M. This cost is in 2012 dollars and is distributed over 5 phases as follow:

Phase 1 - \$17.2M

Phase 2 - \$7.4M

Phase 3 - \$5.6M

Phase 4 - \$7.5M

Phase 5 - \$5.6M

All alternatives apply a new asset management model approach to the business case that factors in such costs as delay impacts to customers due to the terminal being out of service or closed due to a seismic event. The business case assigns significant costs to the risk of a major seismic event interrupting ferry service for an extended period with loss of functional use of the trestle. This approach addresses some but not all of the risk factors.

The rehabilitation alternative defers having to expend a significant amount of initial capital, as the estimate for this alternative. However, deferring this expenditure results in the total cost being greater than the full replacement alternative (\$43.5M versus \$43.2M estimated for the full replacement alternative). The agency would concurrently schedule maintenance activities, annual terminal inspections, replace red-tagged or damaged piling and damaged portions of trestle approximately every 6 years with projects similar to the one described under the No-Build alternative.

The purpose of evaluating the rehabilitation alternative was to develop a method of replacing the trestle incrementally and deferring high capital expenditures. As scoped, the original project proposes to expend approximately \$43.5M. Delaying some of that expense into the future could give decision makers flexibility with funding shortfalls for higher priority projects.

Permitting

Recurring permits or a programmatic permit would be required for in-water work and recurring maintenance. Additionally, the duration of the project will require unique permit allowances that are not typically granted. We find it unlikely that permit agencies would issue a programmatic permit for this 25-year long project; a major reason for this alternative not being recommended. At present the Incidental Harassment Authorization permit is only good for one year. The required permits for this alternative will include:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification – Ecology
- Incidental Harassment Authorization (IHA) – NOAA
- Building Permit – King County

Risks

Similar to many projects at WSF Terminal Engineering, a design is developed that works from a structural and cost perspective. Proceeding to have such a project permitted or accepted from management, environmental staff and from our Tribal liaison is another issue or risk. Other metrics of value to the State in addition to structural integrity of the trestle need equal consideration. The Rehabilitation Alternative scored favorably from a structural and economic perspective; however, it presents significant risks. These risks, or in some cases opportunities, were evaluated along with the rehabilitation design and scored along with the other alternatives. These risks are covered briefly here and in more depth in Section 5.0 and Appendix H – Risk Matrix.

- Permitting this 25-year long project or series of projects
- Assumption that budget/funds are available as necessary for initial cradle system and in out years for subsequent phases that include stormwater treatment
- Tribes could oppose this option due to the increase in over water and benthic coverage
- Implementation of standards for vehicle lanes and ADA are indefinitely delayed
- Recurring construction phases would cause impacts to the community through disruption of service or service revisions

The alternative proposes to replace approximately 60,000 sf of trestle but defers replacement of the deck for some 25 years.

Construction

The construction assumptions include limited periods of in-water work, available funding for recurring construction and maintenance and a 30-year period of evaluation. The phasing for construction and associated maintenance is summarized in Table 7.

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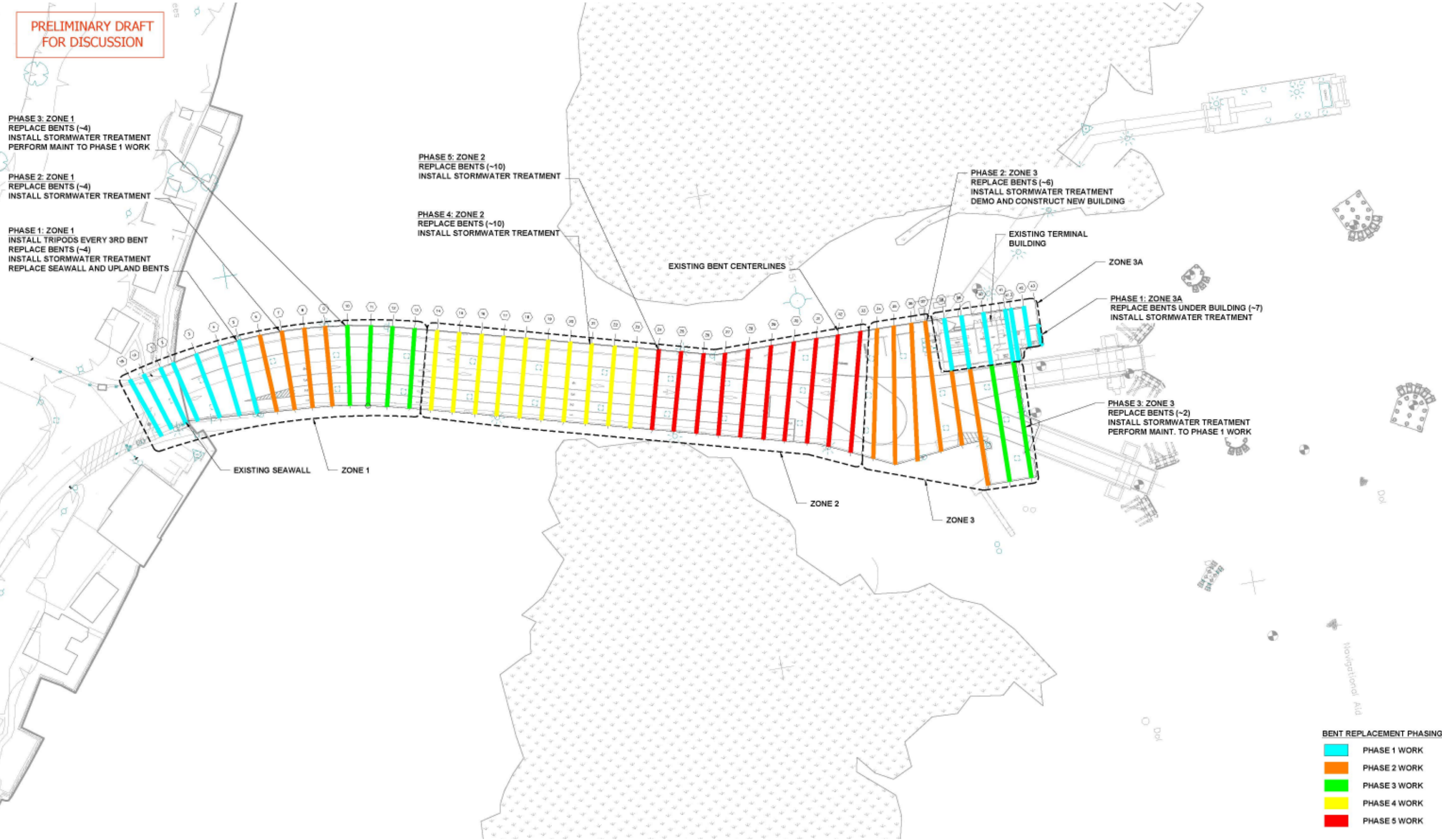


Figure 9: Alternative 2B Phasing

Table 7: Alternative 2B Phasing Summary

<u>Phase</u>	<u>Work Description</u>	<u>Approximate Year of Construction</u>	<u>Estimated Cost</u>	<u>Notes</u>
Phase 1	<u>Zone 1</u> <ul style="list-style-type: none"> • Install Seismic Supports (Tripods) Every 3rd Bent • Replace Bents (~6) • Install Stormwater Treatment • Replace Bulkhead/ Seawall <u>Zone 3A</u> <ul style="list-style-type: none"> • Replace Bents Under Existing Building (~7) • Install Stormwater Treatment 	Approximate Year 1-2	\$17.2M	<p>Replacing bents includes construction of a cradle system with micropiles and removal of existing creosote piles, typical.</p> <p>Existing railing to be replaced in location of replaced bents, typical.</p> <p>Stormwater treatment provided for replaced areas only, typical.</p> <p>Stormwater vault installed upland of bulkhead/seawall</p>
Phase 2	<u>Zone 1</u> <ul style="list-style-type: none"> • Replace Bents (~4) • Install Stormwater Treatment • Maintenance to Phase 1 work <u>Zone 3</u> <ul style="list-style-type: none"> • Replace Bents (~6) • Demo and Replace Terminal Building • Install Stormwater Treatment • Maintenance to Phase 1 work 	Approximate Year 6-7	\$7.4M	<p>Maintenance to previously installed stormwater system occurs annually.</p> <p>New terminal building to be constructed adjacent to existing building prior to demolition.</p>

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<u>Phase</u>	<u>Work Description</u>	<u>Approximate Year of Construction</u>	<u>Estimated Cost</u>	<u>Notes</u>
Phase 3	<u>Zone 1</u> <ul style="list-style-type: none"> • Replace Bents (~4) • Install Stormwater Treatment • Maintenance to Phase 1 & 2 Work <u>Zone 3</u> <ul style="list-style-type: none"> • Replace Bents (~2) • Install Stormwater Treatment • Maintenance to Phase 1 & 2 Work 	Approximate Year 11-12	\$5.6M	Maintenance to previously installed seismic system and cradles occurs on a 10 year interval.
Phase 4	<u>Zone 2</u> <ul style="list-style-type: none"> • Replace Bents (~10) • Install Stormwater Treatment • Maintenance to previous phase work 	Approximate Year 16-17	\$7.5M	
Phase 5	<u>Zone 2</u> <ul style="list-style-type: none"> • Replace Bents (~10) • Install Stormwater Treatment • Maintenance to previous phase work <u>All Zones</u> <ul style="list-style-type: none"> • Replace Utilities 	Approximate Year 21-22	\$5.6M	Utilities for the trestle will not be replaced until all zones have been replaced; assuming utilities cannot be replaced in piece meal fashion.

The rehabilitation alternative incrementally adds structural support to the trestle. Phase 1 seismically stabilizes the trestle to withstand a 975-year earthquake event. More specifically, this alternative adds a cradle system to support existing bents. This alternative also replaces the existing railing on both sides of the trestle and the existing utilities along the west side of the trestle in order to meet code requirements. The railings and utilities; however, will be replaced in Phase 5 in order to avoid a piece meal approach.

All phases of construction will require maintaining traffic accessibility to the slips and holding areas while the trestle is under construction. The design and construction phasing for the VTRP will require extensive consideration of construction procedures in order to maintain operational conditions at the terminal.

Schedule

The alternative will require a phased schedule that will occur over the course of approximately 25-years. The phasing will be similar to that described above. It is assumed that each phase of this alternative will be able to be constructed in 1-2 years.

3.04 Alternative 3 – Partial Replacement (Vital Link)

Overview

The scope of Alternative 3 is to strategically replace sections of the trestle necessary to keep the ferry **terminal functional following a significant seismic event**. This can be accomplished in phases starting with the replacement of the western half and northern end of the trestle (approximately 39,000 sf) and postponing the replacement of the eastern half (holding lanes) until such a project can be funded (approximately 21,000 sf). The western half and northern end trestle replacement is summarized below.

Trestle Structural

The structural components of the trestle replaced under Alternative 3 will likely be a cap and pile structure consisting of either steel piles or concrete piles with concrete pile caps. Replacing the western section of the trestle addresses the essential use of the terminal as a lifeline connection to and from Vashon Island and addresses the minimum operational requirements to maintain functionality of the trestle. The alternative proposes to replace approximately 40,000 sf of trestle. The western trestle replacement includes:

- Constructing a temporary pedestrian walkway along east side of trestle (temporary increase in over water coverage),
- Attaching temporary utilities to the temporary walkway,
- Constructing temporary bus and ADA drop off areas upland of trestle,
- Replacement of the bulkhead/seawall and construction of an upland surface water treatment facility,
- Demolishing utilities,
- Demolishing and rebuilding pedestrian walkway and exit lanes 1 and 2,

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- Installation of a new terminal building onto new trestle,
- Installation of a new utility corridor along the western edge,
- Replacement of the fire protection system; located on west side of trestle, abandon in place system on east side of trestle,
- Constructing a localized treatment system aimed at treating runoff from the furthest offshore areas and a combined drain system that conveys and treats runoff collected from trestle nearest the bulkhead/seawall to an upland vault adjacent to the bulkhead/seawall.
- Demolishing existing terminal building and supporting trestle

Designing a sign bridge that spans the entire trestle if half of the trestle is replaced to one standard while the other half is not replaced is an issue. The overall assumption for each alternative is that the two sign bridges are retained. A new foundation for the sign bridges on the timber side is required for this option; however, it is not a significant issue to impact this option.

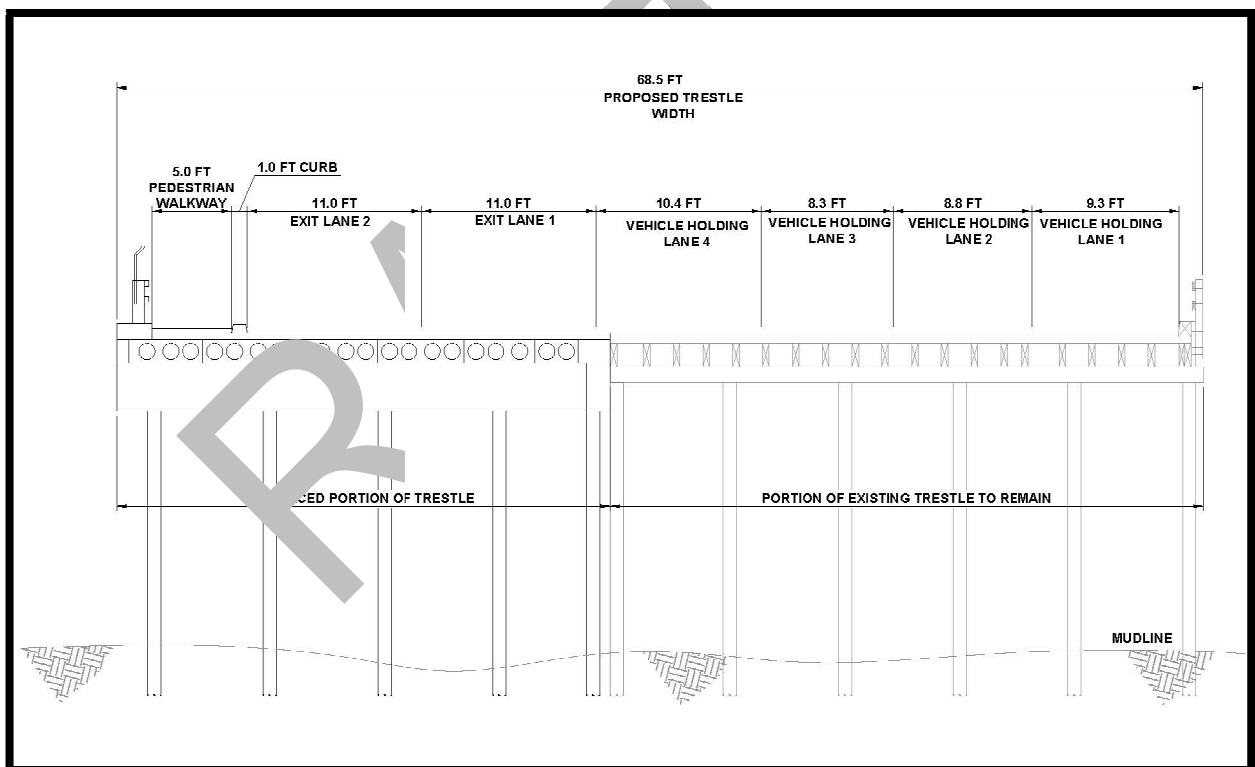


Figure 10: Alternative 3 Cross Section (Looking North)

Replacing the northern section of the trestle has the following benefits:

- Results in a cleaner project by replacing the deepest piles (which are more susceptible to scour, harder to repair/replace, etc.)

- Requires a much shorter transition between timber and concrete structures
- Entire structure could be built from a derrick
- Is more easily phased with less disruption to staging operations (although possibly more disruption to slip operations when two vessels are using the terminal simultaneously)

Bulkhead/Seawall Structural

The bulkhead/seawall is replaced as part of this alternative. The bulkhead/seawall provides the transition from the upland to the trestle and supports the shoreward end of the first set of precast deck elements.

Terminal Building & Waterside Enclosures

Partial replacement of the trestle requires the terminal building and waterside enclosures be replaced. A facility program will be developed for the design during the PS&E phase. This will be taken from the WSF existing draft facilities documents identifying current operational needs and recalculating waiting room and staff areas for appropriate sizing. It is assumed that replacement of the terminal would be slightly larger in some areas to meet current ADA and IBC requirements. Conservatively, this report assumes a 20% increase above the existing structure's square footage. The square footage of the existing structure should include all of the storage closets that are built under the cover of the overhangs.

Structures would be designed to current zoning and building code requirements. The terminal would be fully accessible.

In accordance with RCW 43.17.200, one-half to one percent of the architecture and engineering fees will be used to pay for public art in the new building.

As required by RCW 39.35D High-performance Public Buildings, the new building will meet the design and construction requirements of the LEED Silver Certification.

Pavement

In addition to the replacement of the entire western half and a portion of the northern area of the trestle, the remaining holding lanes (eastern portion of the trestle) are resurfaced. The pavement design will comply with current standards for pavement structures.

A large majority of the repaving will be located on the trestle over water. In the area of the bulkhead/seawall, some repaving may be required on land. In this area, further geotechnical analysis may be required to determine the characteristics of the subgrade soils.

Utilities

It is important to note that partial replacement of utility systems is not recommended; therefore, the partial replacement alternative would completely replace the utility systems. Additionally, this alternative lends itself to provide additional capacity for future utility needs (i.e. additional electrical conduit).

A consolidated drainage systems would be designed to reduce the number of treatment facilities to be maintained and maximize the efficiency of the treatment facility (e.g. minimize the filter area, etc.).

Signage

The partial replacement alternative replaces the sign bridge and upgrades the trestle signage.

Security

The partial replacement alternative allows for ongoing evaluation and reassessment of security needs that can be considered with the initial replacement of the western half of the trestle and replacement of the terminal building

Environmental

This alternative may increase overwater coverage in order to meet current standards for lane widths and accessible paths. It is assumed that an increase in trestle width will be no more than 2 feet. Net overwater coverage may not see an increase if other areas of the trestle can be reduced to account for the increased width.

This alternative reduces the number of piling that are part of the trestle as a significant number of creosote piling are removed and reinforced concrete or steel piling used in place. Reinforced concrete piling will allow for significantly longer spans between bents and therefore fewer piling.

Maintenance and Operations

The associated maintenance and operations of this alternative is significantly less than the No-Build and Rehabilitation alternatives. The replaced portions of the trestle will require significantly less maintenance than in the existing condition. However, the portion of the trestle that is not replaced will require maintenance levels similar to existing conditions and will require increasingly higher levels of maintenance as components further deteriorate until they are replaced in later phases.

Terminal operations will not require additional personnel under this alternative. The overall operations of the terminal will likely become more efficient in that the deficiencies that are currently experienced by the terminal can be addressed during the design of the replacement trestle and terminal building.

Cost

The estimated cost of this alternative is \$31.8M in 2012 dollars.

Permitting

The required permits for this alternative will include:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification (Ecology)
- Incidental Harassment Authorization (NOAA)
- Building Permit (King County)

Risk

The risks associated with this alternative, as well as opportunities, were evaluated along with the design and scored. These risks are covered briefly here and in more depth in Section 5.0 and Appendix H – Risk Matrix.

- Assumption that budget/funds are available as necessary for initial replacement
- Tribes could oppose this option due to the increase in over water coverage,
- Implementation of standards for vehicle lanes is delayed,
- Recurring construction phases would cause impacts to the community through disruption of service or service revisions

Construction

The partial replacement requires construction activities in water and from shore. The shoreward most bents are not accessible by derrick as the water depth is too shallow. This requires unique phasing considerations during the design phase for this alternative.

Additionally, replacing a portion of the trestle will reduce the holding area of the trestle significantly during construction. Assuming replacement of the exit lanes, two of the four holding lanes are converted to exit lanes during construction. This also requires additional upland holding either in a parking area or along Vashon Hwy. Interruptions to operations is foreseeable throughout construction and will require mitigation.

All phases of construction will require maintaining traffic accessibility to the slips and holding areas while the trestle is under construction. The design and construction phasing for the VTRP will require extensive consideration of construction procedures in order to maintain operational conditions at the terminal.

The replacement terminal building has to be fully operational prior removing the existing building. Due to this constraint, the new terminal building will be constructed adjacent to the existing building.

Schedule

It is assumed that this alternative will be able to be constructed in 2-3 years.

3.05 Alternative 4 – Full Replacement

Overview

The scope for the full replacement alternative is to demolish and reconstruct the trestle, the terminal building, and the bulkhead/seawall in the current location (approximately 60,000 sf total overwater coverage).

The trestle is constructed over the footprint of the existing facility. The proposed facility will include a new 60" clear pedestrian access way, two vehicle 11'-0" exit lanes, two 9'-0" vehicle holding lanes, one 10'-0" vehicle holding lane, one 11'-0" utility vehicle holding lane, and a bus turn-around and drop-off area. The pedestrian access and the exit lanes will be separated by an approved traffic barrier. There will also be a new traffic barrier to the west of the vehicle

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holding lanes. The eastern holding lane will be designated as a “Utility Lane,” which will be signed for use by Operations for vehicles requiring a greater amount of maneuvering room than a standard vehicle. Such operations include the turning and staging of trucks required to back onto the ferry and emergency access for fire trucks and oversized service vehicles.

A new concrete bulkhead/seawall will be installed behind the existing timber bulkhead/seawall.

A new passenger terminal building will be located to the south of the existing facility. An additional 1600 square foot building, dedicated for staff use will be provided at the north end of the trestle. Alternative 4 also provides sufficient storage for the Operations staff located in the buildings as well as by the tie-up slip. Two maintenance parking stalls will be provided to the side of the terminal building as well as an ADA drop off stall.

A designated lane for use of motorcycles and bicycles will not be provided in order to minimize any increases in overwater coverage. Instead, a bicycle holding zone will be provided adjacent to the main slips consistent with the existing conditions.

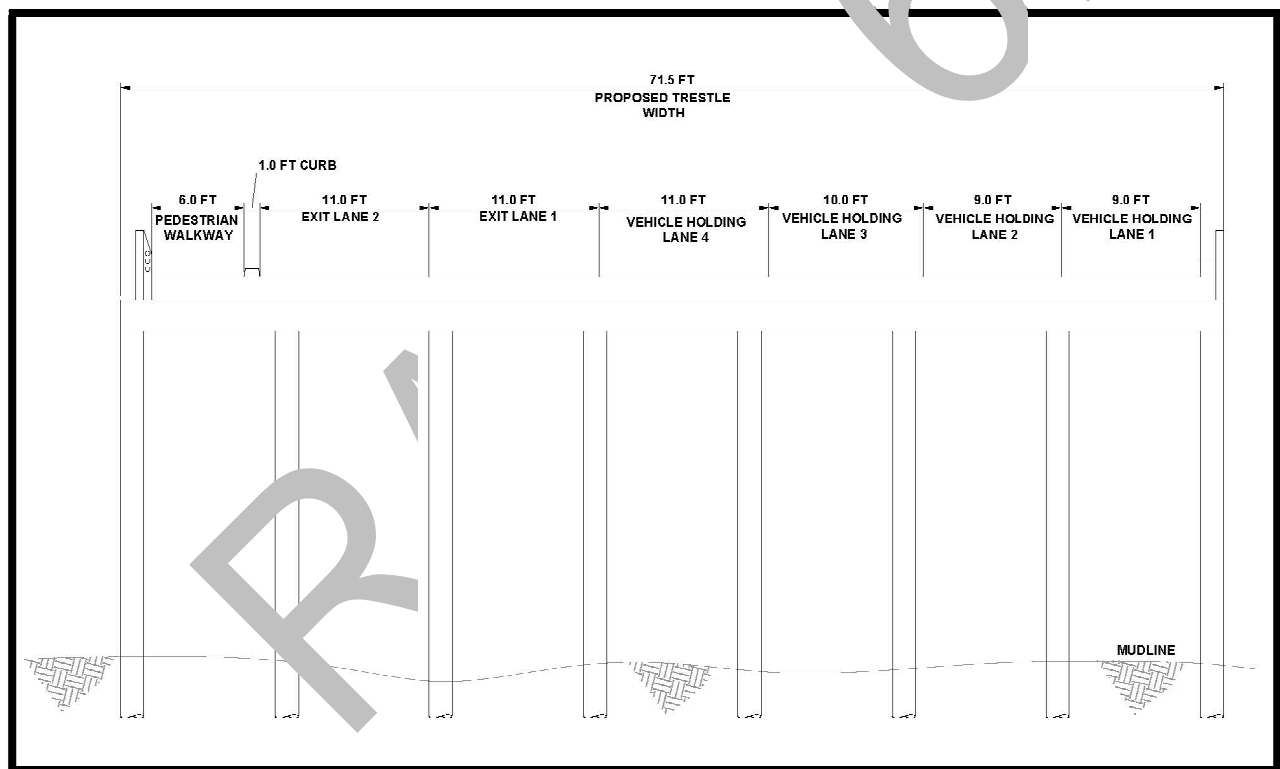


Figure 11: Alternative 4 Cross Section (Looking North)

Trestle Structural

The structural components of the trestle replaced under Alternative 4 will likely be a cap and pile structure consisting of either steel piles or reinforced concrete piles with concrete pile caps. The alternative proposes to replace approximately 60,000 sf of trestle.

Bulkhead/Seawall Structural

The bulkhead/seawall provides the transition from the upland to the trestle and supports the shoreward end of the first set of precast deck elements. Typically, the bulkhead/seawall consists of a combination of pipe piles driven for bearing to support the dead load and vehicle loads and sheet piles to hold the upland soil in place. A cast-in-place concrete cap ties the two elements together. Riprap is placed in front of the sheet piles as protection from wave energy and scour. Where the ground line at the bulkhead/seawall is high enough to be permanently well above the high tide water level, a more conventional spread footing may be feasible and less expensive. Given the 75-year design life and potential rises in sea level in that time period, the effects of a rise of 1 to 3 feet should be accounted for in the selection of the type of bulkhead/seawall to be constructed.

According to the WSDOT Bridge Design Manual, all new structures require approach slabs to mitigate differential settlement adjacent to the end piers unless their use is determined to be inappropriate. The Geotechnical Branch has determined there are no reasons to eliminate approach slabs.

Terminal Building & Waterside Enclosures

Replacement of the dock structure requires the terminal building and waterside enclosures be replaced. A facility program will be developed for the design. This will be taken from the WSF existing draft facilities documents identifying current operational needs and recalculating waiting room and staff areas for appropriate sizing. It is assumed that replacement of the terminal would be slightly larger in some areas to meet current ADA and IBC requirements. Conservatively, this report assumes a 20% increase above the existing structure's square footage. The square footage of the existing structure should include all of the storage closets that are built under the cover of the overhangs.

Structures would be designed to current zoning and building code requirements. The terminal would be fully accessible.

In accordance with RCW 43.17.200, one-half to one percent of the architecture and engineering fees will be used to pay for public art in the new building.

As required by RCW 39.35D High-performance Public Buildings, the new building will meet the design and construction requirements of the LEED Silver Certification.

Pavement

The full replacement of the trestle includes providing new pavement for the holding lanes, exit lanes, pedestrian access, vehicle turnaround, and other miscellaneous areas.

The pavement design will comply with the 1993 AASHTO Guide for the Design of Pavement Structures and the WSDOT Pavement Policy. The policy specifies a design life for minor arterial roadways with 18,000 lbs equivalent single axle loads (ESALs) greater than 100,000 per year of 50 years. The pavement design will consider amount of future vehicle traffic expected through the terminal based on projections contained in the WSF Long Range Plan.

The pavement design will consider amount of future vehicle traffic expected through the terminal. The table below provides vehicle ridership data for 2010 and forecasted vehicle ridership for 2030 Ridership Forecast By Route (Vehicles per year).

Table 8: Vashon Ridership Data

Route	2010 (From WSF Traffic Statistics)	2030* (From WSF Long Range Plan)
Vashon-Southworth	98,388	237,000
Vashon-Fauntleroy	1,119,430	1,427,000

This project will consider both ACP and PCC for pavement on the trestle based off a cost-benefit analysis. Pervious pavement is not feasible due to leakage into the trestle substructure and storm drainage requirements.

A large majority of the repaving will be located on the trestle over water. In the area of the bulkhead/seawall, some repaving may be required on land. In this area, further geotechnical analysis may be required to determine the characteristics of the subgrade soils.

The design of the pavement will take into account the following additional considerations:

- Pavement thickness constraints.
- The unique loading of slow-moving vehicles
- Freeze-thaw – ice, snow removal

Utilities

The full replacement alternative consists of bringing all power and communication systems up to current codes. The 16-year plan does not call for the replacement of the existing transfer spans; therefore, there likely will not be the need for a power increase to the terminal. During design, the goal will be to develop a design that reduces overall power demand at the terminal by using more energy efficient products consistent with the State's mandate to reduce overall energy use.

A preliminary analysis of the utility location determined that the desired location from an operational perspective is in the current location, along the west side of the trestle, adjacent to the pedestrian walkway. Locating the utilities inside a protected metal case inside the railing on the west side of the pedestrian walkway is the preferred method for the purposes of the predesign study. This option provides easy access for maintenance and is the least disruptive to operations on the trestle. This option does; however, encroach on the available area for the pedestrian access way.

The Full Replacement alternative will likely include a new communication system located along the west side of the trestle, adjacent to the pedestrian walkway.

Additional configurations for routing the utilities were considered including:

- Locating utilities in an utilidor between traffic lanes on the trestle,
- Locating utilities in a utility tunnel in a pile cap, and
- Adding a grated utility cantilever to the side of the pedestrian walkway.

These routing configurations were not selected due to the likelihood of maintenance and operation issues, as well as additional cost.

The Full Replacement alternative, does not trigger stormwater treatment requirements based on current standards if the overwater footprint is unchanged. However, the alternative includes stormwater treatment in order to be consistent with WSF environmental policies, as well as respond to public expectation that a structure supporting idling vehicles would treat its stormwater. This alternative provides the maximum flexibility for incorporating treatment structures into the design.

Signage

New signage will be provided throughout the new terminal. This will include signage that is consistent with current standards.

The Replacement alternative will address any signage deficiencies at the terminal. The option replaces the two existing sign bridges with new sign bridges to structural code and could support Variable Message Signs. This option will also address the lack of wayfinding on the trestle and within the terminal building by adding additional informational signs. The option will consider providing vehicle and passenger fare signs for passengers.

Security

The replacement alternative also will support modifications to the terminal and provide flexibility for any changes in MARSEC conditions or revisions necessary to comply with changes to Homeland Security requirements in the future.

Environmental

This alternative may increase overwater coverage in order to meet current standards for lane widths and accessible paths. It is assumed that an increase in trestle width will be no more than 2 feet. Net overwater coverage may see no change if other areas of the trestle can be reduced to account for the increased width.

This alternative reduces the number of piling that are part of the trestle as all of the existing creosote piling will be removed and replaced with reinforced concrete piling. Concrete piling will allow for longer spans between bents and therefore fewer piles.

Maintenance and Operations

The associated maintenance and operations of this alternative will be the least of all alternatives. The various components of the trestle will require routine maintenance on an assumed 10-year interval.

Terminal operations will not require additional personnel under this alternative. The overall operations of the terminal will likely become more efficient in that the deficiencies that are currently experienced by the terminal can be addressed during the design of the replacement trestle and terminal building.

Cost

The estimated cost of this alternative is \$43.2 in 2012 dollars.

Permitting

The required permits for this alternative will include:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification (Ecology)
- Incidental Harassment Authorization (NOAA)
- King County Building Permit for new terminal building

Risk

The risks associated with this alternative, as well as opportunities, were evaluated. These risks are covered in depth in Section 5.0. Note that the risks associated with this alternative are much less than the risks of the Partial Replacement Alternative.

Construction

The replacement of the trestle will require construction activities both in water and from shore. The shoreward most bents are not accessible by derrick as the water depth is too shallow. This will require unique phasing considerations during the design phase for this alternative.

Additionally, in order to maintain operations during construction, the trestle will be replaced in phases. Replacing a portion of the trestle at a time will reduce the holding area of the trestle significantly during construction. Assuming replacement of the exit lanes first, two of the four holding lanes will be converted to exit lanes during construction. This will require additional upland holding either in an offsite parking area or along Vashon Hwy.

All phases of construction will require maintaining traffic accessibility to the slips and holding areas while the trestle is under construction. The design and construction phasing for the VTRP will require extensive consideration of construction procedures in order to maintain operational conditions at the terminal.

The replacement terminal building will be required to be fully operational prior to the removal of the existing building. Due to this constraint, the new terminal building will be constructed adjacent to the existing building.

Schedule

It is assumed that this alternative will be able to be constructed in 3-4 years.

4.0 PROJECT BUDGET ANALYSIS

Preservation work to the Vashon timber trestle and bulkhead/seawall has been in planning for nearly fourteen years, since the timber structures were originally due for replacement. Consistent with the requirements of Engrossed Substitute House Bill (ESHB) 1094, Washington State Ferries (WSF) maintains a Life Cycle Cost Model (LCCM), which ensures that the life cycles of WSF structures are in accordance with industry standards and department adopted standards based on experience. The LCCM provides age information and dictates remaining service life information for all of WSF terminals. A new Asset Management Model was also used in evaluating alternatives for replacing the trestle.

The Vashon facilities are listed on WSDOT's Life Cycle Cost Model (LCCM). The LCCM shows all of the facility components due for replacement between 2013 and 2031, as shown on the No-Build Alternative. In addition to other facility deficiencies, the existing structures do not meet current seismic codes. The eight projects identified in the LCCM are summarized in Table 9.

[This section to be completed by WSF when additional information is available]

Table 9: Existing Facilities LCCM

Project ID	Year Due ¹	Closure Required
1. Pavement on Timber Trestle		
2. Security Upgrades: Electronic Door Locks; Video Monitoring		
3. Dolphin Replacement, Left Inner		
4. Paving Upland Holding Area & Traffic Lanes		
5. Security Upgrades: Sensors & Alarms; Hirsch Hardware		
6. Toll Booth Replacement		
7. Replacement of Bridge, Trestle, Wingwall, & Terminal Building Facilities		
8. Dolphin Replacement, Right Inner		

¹ The Year Due range results from multiple components of the project having various life cycle ending dates.

Improvements recently completed at the Vashon ferry terminal are described in Table 6 and include:

- Deck Repair/ Resurfacing, July 2009
- Slip 1 Bridge Seat Seismic Retrofit, June 2010
- Trestle Preservation, Oct. 2010
- Slip 2 Bridge Seat Seismic Retrofit, Aug. 2011

4.01 Project Funding

At present, the Vashon Timber Trestle & Terminal Replacement Project is not funded through construction. Funding for capital projects such as this will be a major topic of discussion during the next legislative session. It is anticipated that these conversations will continue over the next several months.

The project funding is outlined below in Table 10. A comparison of the project funding with the estimate cost for each alternative is shown in

Table 11. A portion of expenditures are not within the YOE. The budget values and their allocation by biennium periods is expected to change.

[This section to be completed by WSF when additional information is available]

Table 10: Project Funding

Funding Source	Budgeted Amount	Expended	Remaining Funds
State			
Federal			
Total			

Table 11: Project Budget

Project Phase	Budget	Alternative Project Cost				
		Alternative 1: No-Build	Alternative 2A: Bracing	Alternative 2B: Rehab	Alternative 3: Partial	Alternative 4: Full
Preliminary Engineering						
Right-of-Way Phase						
Const Phase						\$43.2M
Total						
Note: Above values are in 2012 Dollars and are subject to change						

4.02 Benefit/ Cost Analysis

This section documents the work done to produce a benefit/cost analysis with the purpose of quantifying key economic benefits to WSF, riders, and other stakeholders. The key question to

be addressed here is: *Which of the four identified alternatives for the Vashon Timber Trestle & Terminal Replacement Project produces the most net benefit to WSF and its stakeholders?* A summary was developed of the important cost and benefit drivers by which the project alternatives should be evaluated.

A benefit/cost analysis of this type requires a base case, against which costs and benefits can be calculated. To answer the question “how good is this alternative?” it is necessary to know what would be done otherwise. This base case is sometimes called “No-Build”; however, it is not realistic for WSF to actually do nothing, including no preservation spending. Therefore, preservation-only is treated as the base case and assumes that in the absence of a rebuild project WSF will replace individual aging assets at the most economically optimal time (e.g., replacement of failing piles with stub pile, additional cross bracing, etc).

The approach is to estimate the net benefit of each alternative relative to the base case (No-Build Alternative). The analysis determines the degree to which each alternative differs from No-Build in terms of all relevant costs, including capital, maintenance and operations, and ridership costs such as delays and the risk of missed sailings.

An important factor to consider when performing benefit/costs analyses is the use of discount factors, which are used to calculate Net Present Values of future cash flows. For public projects, a “Social Discount Rate” (SDR) is a measure used to help guide public agency choices about the value of diverting funds to social projects, such as highways, schools, or ferry facilities. It is defined as “the appropriate value of interest rate to use in computing present discount value for social investments.” The SDR used reflects two factors: 1) the time value of money (a dollar today is worth more than a dollar tomorrow, at the risk-free rate); and 2) a risk premium which reflects an extra return that investors demand to compensate for the risk that the future benefits might not materialize as expected.

Determining this rate is not always easy and can be the subject of discrepancies in the true net benefit to certain projects, plans and policies. The proper discount rate should represent the opportunity cost of what else the agency could accomplish with those same funds. However, in the case where this evaluation is focused on what must be done at the Vashon ferry terminal, this involves only comparing against what other project alternatives are viable.

Calculating the true social marginal cost is easier than calculating social marginal benefit. Many of the benefits from new ferry facilities may be intangible, for instance related to reducing unquantifiable risks to the stakeholders and taxpayers. Another problem is that often the current generation will be paying for most of the costs while future generations will be reaping most of the benefit. The best example of this is that taxpayers three or four generations ago made the capital investment to construct the Vashon terminal that must now be replaced; but the current generation has enjoyed the benefits of having that terminal available without having made that capital investment.

Using too high a SDR results in decision making where current investment are minimized and future benefits aren’t valued (i.e., there is risk that those future benefits won’t be realized). Using too low a SDR understates the time value of money and places too high a value on future cash flows. One valid position is that the SDR should equate to the current rate at which the state can borrow money through bond placement. Values of SDR to be used should generally be lower than discount rates used for private sector projects. The ability of the state

to deliver projects which have long life expectancy and utility to the public would argue for using lower SDRs.

Since it is not clear which SDR rate to use, this benefit/cost analysis will provide an evaluation using four SDR rates: 1%, 3% 5% and 7%. This will provide a sensitivity analysis on the results to illustrate what the effects are for changing this assumption.

Although the design life for each alternative is 75 years, the benefit/cost evaluation will only examine costs for the next 30 years, which should suffice to provide cost comparisons.

4.03 Asset Management Model

A new asset management model was applied to the considered alternatives. This model was developed for terminal engineering facilities and factors in costs for delay impacts to customers due to terminal closures because of a seismic event. The asset management model assigned significant costs to the risk of a major seismic event interrupting ferry service for an extended period with loss of functional use of the trestle.

4.04 Cost Estimate Assumptions

The business case quantifies the differences between alternatives not only in terms of direct costs, which are relatively well known, but also in terms of how well they serve ridership and other stakeholders. Below is a summary of the ways in which the alternatives differ.

- *Cost, including risk.* The most obvious difference among alternatives is cost, including construction-related risk, that have been estimated in the construction cost estimates.
- *Construction outage.* The alternatives vary in terms of how long the terminal must be shut down during construction. A shutdown imposes costs on the riders, both at Southworth and at Fauntleroy, which are served by the Vashon terminal.
- *Life-cycle risk and maintenance cost of operational assets.* Depending on when the assets are replaced, the cost due to risk and maintenance varies (i.e., older assets are expected to have higher risk and maintenance costs).

A cost estimate for each of the alternatives was developed. Improvement options have similar cost assumptions. The major assumptions used in preparing the cost estimates are summarized below for each of the build alternatives.

Alternative 1 – No-Build

The No-Build (Preservation Only) alternative is to continue operation of the trestle, replacing trestle and terminal assets as they reach the end of their economic life. Although the LCCM suggests that much of the capital preservation replacements will be scattered over the next twenty years, WSF's risk-based Asset Management model shows that most of the operational assets are actually due for replacement now, and that delaying replacement increases total expected cost, including the expected cost due to possible failures of aging equipment.

Alternative 2A – Seismic Bracing

The Seismic Bracing alternative upgrades the existing trestle to current seismic standards. Work is done to seismically stabilize the entire trestle by constructing outboard tripod pile systems and adding a cradle system. No upgrades are provided for other components of the trestle.

Alternative 2B – Rehabilitation

The Rehabilitation alternative looks to replace the terminal and trestle in a phased series of construction activities over twenty-five years. In the first phase that would be conducted in the first two years, work is done to seismically stabilize the entire trestle by constructing outboard tripod pile systems and replacing key bents with the cradle system (identical to Alternative 2A). Over the next twenty five years, the remaining bents would be re-constructed with cradle systems with priority based on their susceptibility for failure.

Alternative 3 – Partial Replacement (Vital Link)

The Vital Link alternative would replace the trestle in the area of the two egress lanes with concrete structures during the first year of the project.

Alternative 4 – Full Replacement

The full replacement alternative would replace the entire trestle excluding the bridge seats, the bulkhead/seawall, terminal building, and utilities.

4.05 Detailed Estimates

Detailed program estimates for the five alternatives considered are provided in Appendix C and are summarized in the table below.

Table 12: Project Estimates

Alternative	Alt 1	Alt 2A	Alt2B	Alt 3	Alt 4
Expended Design Fees	N/A				
Initial Investment (2012\$)	N/A				
30 yr. Maint. And Ops					
LCCM					
Total 30-yr costs (2012 \$)					
Benefit-Cost Ratio (1% Discount Rate)					
Benefit-Cost Ratio (3% Discount Rate)					
Benefit-Cost Ratio (5% Discount Rate)					
Benefit-Cost Ratio (7% Discount Rate)					

The cost estimates are based on 2012 unit costs and pervious bid tab history inflated to 2012. The preliminary and construction engineering percentages, as well as the construction contingency and miscellaneous item allowance were based on the Plans Preparation Manual, Section 830.03, June 2011

5.0 COMPARISON OF ALTERNATIVES

This section provides a brief comparison of the alternatives on their effectiveness in addressing the project's purpose and need, taking into account the proposed facility improvements and the potential environmental impacts of each.

Several issues affect the ability of the alternatives to respond to the safety and security concerns for the current terminal. The issues are summarized below in Table 13 and in more detail in Appendix I.

Table 13: Summary of Alternatives Matrix

Project Element	Alternative 1 No-Build	Alternative 2A Seismic Bracing	Alternative 2B Rehabilitation	Alternative 3 Partial Replace	Alternative 4 Full Replace
Description	<ul style="list-style-type: none"> Indefinite deferring of major capital improvements Recurring, small capital maintenance contracts for critical areas Keep trestle minimally functional 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Minimum work/replacement – shorter life cycle Capital maintenance/repair contracts for 25 years Deferring replacement of major work 20-30 years Keep trestle operationally functional to current service 	<ul style="list-style-type: none"> Replace approx. half of existing trestle Replace terminal building Provides “Vital Link” 	<ul style="list-style-type: none"> Replacement of timber trestle Same relative overwater footprint
Life Cycle Cost					
Cost Benefit Ratio					
Environmental	<ul style="list-style-type: none"> No immediate impacts Long term impact of deteriorated piles/timbers in water 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Recurring permits for small projects to maintain existing facilities Removes creosote timber in stages Provides stormwater treatment 	<ul style="list-style-type: none"> Potential impact to negotiations with tribes Removes creosote timber Provides stormwater treatment Fish windows limit in-water work 	<ul style="list-style-type: none"> Potential increase of over water coverage and impact to negotiations with tribes Fish windows limit in-water work

Project Element	Alternative 1 No-Build	Alternative 2A Seismic Bracing	Alternative 2B Rehabilitation	Alternative 3 Partial Replace	Alternative 4 Full Replace
Permitting/ Risk	<ul style="list-style-type: none"> Does not address risk factors No permitting Required 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Replaces most vulnerable portions of the trestle first Removes creosote piling Provides stormwater treatment Requires recurring or programmatic permit 	<ul style="list-style-type: none"> Provides a vital link between shore and vessels Removes creosote piling Provides stormwater treatment Requires Corp permit, HPA, and Building Permit 	<ul style="list-style-type: none"> Addresses most risk factors Full funding may not be available Requires Corp permit, HPA, and Building Permit
Maintenance & Operations	<ul style="list-style-type: none"> No immediate impacts Continued deterioration of structure Increasing yearly maintenance costs and more frequent inspection 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Estimated 10 year maintenance interval More recurring maintenance needs Increasing yearly maintenance costs and more frequent inspection 	<ul style="list-style-type: none"> Less ongoing maintenance costs Extends life of key elements 	<ul style="list-style-type: none"> Highly reduced ongoing maintenance costs Extends life of key elements
Construction	<ul style="list-style-type: none"> No immediate impact Small recurring maintenance contracts for critical areas 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Small construction contracts scheduled for issues 5 total phases over 25 year period Complex construction methods required 	<ul style="list-style-type: none"> Contract and duration 2-3 years 	<ul style="list-style-type: none"> Contract and duration 3-4 years
Note:					

5.01 Life Cycle Cost

[This section to be completed by WSF when additional information is available]

5.02 Benefit – Cost Ratio

[This section to be completed by WSF when additional information is available]

Table 14: Benefit Cost Ratio

Alternative	Alt 1	Alt 2A	Alt 2B	Alt 3	Alt 4
Benefit-Cost Ratio (1% Discount Rate)					
Benefit-Cost Ratio (3% Discount Rate)					
Benefit-Cost Ratio (5% Discount Rate)					
Benefit-Cost Ratio (7% Discount Rate)					

5.03 Environmental

The VTRP has several opportunities to address existing shortfalls with the existing terminals impact on the environment. The existing terminal provides no treatment for stormwater and contains a large number of creosote timber piles, which pollute the Puget Sound and reduce habitat for aquatic species. The No-Build alternative and Alternative 2A perpetuate this scenario and do not address any environmental concerns.

Alternative 2B removes the existing creosote piles over the course of the 25-year project and will provide stormwater treatment as areas of the trestle are replaced. Although the timber piles are replaced, albeit in a phased manner, the overwater coverage and benthic coverage increases with this alternative due to the additional piles required for the tripod/ cradle design.

Alternatives 2B, 3, and 4 will require formal ESA consultations if steel piling is impact driven (or proofed). State-funded formal consultations are US Corps of Engineers lead. Additionally, these alternatives may result in an informal ESA consultation if concrete piling (or other material) is used (avoids in-water noise issues).

Marine Mammal Protection Act (MMPA) compliance needs consideration to avoid project interruption during pile driving. MMPA compliance will likely be required if the project receives federal funding. Requesting harassment level take under MMPA requires formal LTAA ESA determination for ESA-listed marine mammals.

If project receives federal funding, ESA consultations (formal and informal) will likely be federal funding agency lead.

Eelgrass protection will be required. Eelgrass mitigation may be required if pile removal in Alternatives 2B, 3 and 4 results in turbidity impacts to eelgrass.

The King County Shoreline Permit will likely require sediment sampling for contamination if over 200 piles are removed as part of Alternatives 2B, 3, and 4. If sediment contamination is present, King County may require cleanup. This is currently a requirement of the Vashon terminal Programmatic Maintenance and Repair Shoreline Permit with King County.

5.04 Permitting/ Risk

The major risks that have been identified as part of this project are summarized in the text below and in Table 15. Risk matrices for Alternative 2B (Rehabilitation) and Alternative 3 (Partial Replacement) are contained in Appendix H – Risk Matrix. Risk matrices for Alternative 1 (No-Build) and Alternative 4 (Full Replacement) were not generated as part of this pre-design study. By observation risk is inherently the greatest with Alternative 1 and the lowest with Alternative 4.

Budget

It is recognized that the State's budget does not allow it to fund all the projects it would like due in large part to the recent recession. The pre-design study considered this when developing alternatives to the full-replacement of the trestle. While studying the No-Build alternative that is part of all Pre-Design Studies, the design team also developed a project that replaces a portion of trestle to keep it functional following a seismic event. This also allows for deferred replacement of the remaining portion of trestle, a portion of trestle less valuable to operations, over time as funding become available.

Island Demographics

There are over 10,000 residents on Vashon and Maury Island, many of whom depend on the Vashon ferry terminal to commute to work in Seattle. Our analysis determined that the Vashon trestle is highly vulnerable to damage following a seismic event; the furthest offshore portion of trestle could fail during a 72-year event. An event that closes the terminal would limit residents to access the island from the ferry terminal to the south, Tahlequah, and get to Seattle via Point Defiance and Tacoma. Such a commute is more than an inconvenience to island residents, as it would add hours to one's commute. Additionally, such a situation assumes that the same seismic event that closes the Vashon terminal causes minimal damage to the Tahlequah terminal, a one-slip terminal that was constructed in 1958, a year after the Vashon trestle was constructed; therefore, designed to the same structural codes at the time. It is highly likely that the Tahlequah terminal could be significantly damaged in the same event resulting in a loss of all surface transportation for an extended period until at least one terminal servicing Vashon Island is repaired.

Tribal Concerns

Early consultation with the Puyallup Tribe described the replacement project as one which would remove the creosote treated timber trestle and replace it with one composed of significantly fewer concrete or steel piling, freeing up significant benthic environment and removing over 560 creosote treated pilings from the Puget Sound. The replacement project also proposed treating surface water from the proposed concrete trestle (over 50,000 sf) consistent with the Puget Sound Tribes and the Governor's goal to clean Puget Sound in an

effort to improve salmon habitat. Two of the four alternatives being considered as part of this study fail to address these issues.

ADA Compliance

The existing trestle does not meet current ADA standards. Specifically, the pedestrian access is as small as 4-feet wide. Two of the four alternatives being considered as part of this study does not address this limitation.

Stormwater Treatment

The Department of Ecology has concerns with stormwater treatment. The current trestle does not treat any stormwater runoff. Likewise, the road accessing the terminal, Vashon Highway, conveys a majority of its runoff onto the trestle and to Puget Sound untreated. The shoulder of Vashon Highway serves as a vehicular holding lane.

Life Cycle Cost Analysis (LCCA) / Life Cycle Cost Model (LCCM)

The effective use of LCCA is vital in demonstrating that a ferry system's project request is not only the best solution for the system itself, but also for the State of Washington.

The project was originally scoped based on the LCCM which currently rates the trestle as "good". The LCCM is rated in part based on annual inspections and ongoing maintenance. Those assigning an LCCM rating are not necessarily qualified to assign a seismic rating to a trestle nor do they take into consideration the added importance a terminal has on a community with no other way off the island in the event of an emergency. Still, the LCCM has value when rating structures.

Asset Management

While a Life Cycle Cost Model (LCCM) was used to scope the replacement project, the design team used an Asset Management model (AMM) in an effort to justify the replacement project; the implication being that there might be a strategic way to value the limited State funds using the model's output. While the model proved helpful in understanding the value to delay expending capital, in many respects it overlooked evaluating many of the important issues that arose during the study. Results from the model were heavily influenced by data generated from a WSDOT survey of customers in which the customers were asked how much they'd be willing to pay to reduce their commute time, how much a 10 minute delay was worth; the survey did not consider an earthquake scenario that shuts down the terminal indefinitely. Near the end of the study, it appeared that the alternative being favored by the AMM did not incorporate significant risks and opportunities that were difficult assign a cost. To the Asset Management model, we ended up adding the risk matrix which put a value on these risks or opportunities.

Various Tools for Analysis

Using the Life Cycle Cost Model (LCCM) provides one perspective regarding integrity of the ferry terminal. The AMM permits an examination of the trestle from another perspective. Both models are useful tools used to evaluate expenditure of capital funds. The strategic and best value is based a large part on agency values while considering the overall availability of funds for the State budget. Issues typically not considered in these models include consideration of an island community emergency response plan in the case of an earthquake or postponing

action and continuing to accept risk, These are issues the Pre-Design Study explores. There is no one right answer yet after a lengthy analysis, one alternative always seems to rise to the top.

Historical/ Archeological Risk

This project will require a cultural resources inventory and assessment of archaeological and historical resources within the project area. According to a preliminary records search, the proposed project area has not been previously assessed for archaeological resources. Historic resources have been assessed, but official determinations have not been completed.

Although there is limited information at this time, given the assumed project parameters, the known cultural resources within the project area do not appear to be significant.

Permitting

Permitting will be required for Alternatives 2A, 2B, 3, and 4. These three alternatives have similar levels of permitting requirements with the exception that Alternative 2B will require specific programmatic or recurring permits which may be difficult to obtain. The permits that these alternatives require include the following:

- WDFW HPA permit. An HPA may require pre/post project eelgrass surveys and any impacts to eelgrass will likely result in mitigation requirements.
- King County Shoreline Permit
- King Co. Critical Areas Ordinance Permit.
- Alternatives 3 and 4 will require King Co. Building Permit for construction of a new terminal building.
- NW3 permit from the Corps
- Ecology Water Quality Certification and Coastal Zone Management Certification will likely be required

The following table summarizes the aforementioned risks for each of the project alternatives.

Table 15: Summary of Risk Matrix

Project Risk	Alt 1	Alt 2A	Alt 2B	Alt 3	Alt 4
Budget	Low	Low	High	Moderate	High
Island Demographics	High	Moderate	Moderate	Moderate	Low
Tribal Concerns	High	High	Moderate	Low	Low
ADA Compliance	High	High	High	Low	Low
Stormwater Treatment	High	High	Moderate	Low	Low
LCCA/LCCM					

Asset Management					
Historical/ Archeological	Low	Low	Low	Low	Low

5.05 Maintenance and Operations

Maintenance requirements of the four alternatives varies significantly with Alternative 1 having the highest level of required maintenance, followed by Alternative 2, Alternative 3, and Alternative 4 with the lowest amount of required maintenance.

Alternative 1 (No-Build) will require a similar level of maintenance as the existing condition; however, this requirement will steadily increase as the structure further deteriorates.

Alternative 2A (Seismic Bracing) will have a significant level of maintenance required as a result of the large amount of additional structural members that are added to the trestle. A majority of these members are steel and will corrode and deteriorate without proper maintenance.

Alternative 2B (Rehabilitation) will have a significant level of maintenance required as a result of the large amount of additional structural members that are added to the trestle over the course of 25-years. A majority of these members are steel and will corrode and deteriorate without proper maintenance.

Alternative 3 (Partial Replacement) has a relatively low level of maintenance, as approximately two-thirds of the trestle will be a new structure. The new structure will require typical maintenance associated with new structures. The remaining structure that is not replaced will require similar levels of maintenance to the existing condition.

Alternative 4 (Full Replacement) provides significant reductions in maintenance requirements and cost. The new structure will receive routine maintenance per WSF standards.

Terminal operations will not require additional personnel under these alternatives. The overall operations of the terminal will likely become more efficient under Alternatives 3 and 4 in that deficiencies currently experienced by the terminal will be addressed during the design of the replacement trestle and terminal building.

5.06 Construction

Construction methods and durations vary amongst the four alternatives. Under all alternatives the terminal will be required to maintain operational functionality, including the use of the terminal building. The unique elements of construction for each alternative are described below.

Alternative 1 requires no unique construction processes by definition.

Alternative 2A (Seismic Bracing) will require a unique construction process and further analysis during the PS&E phase. The complexities of construction with this alternative arise in placing the tripod and cradle system. The cradle system is comprised of large wide-flange and channel shape structural members, inserted underneath the trestle and perpendicular to the shoreline.

Alternative 2 (Rehabilitation) will require a unique construction process and further analysis during the PS&E phase. The complexities of construction with this alternative arise in placing the tripod and cradle system. The cradle system is comprised of large wide-flange and channel shape structural members, inserted underneath the trestle and perpendicular to the shoreline. The method in which these members are inserted below deck without significantly interrupting terminal operations is unknown as construction activities near shore is constrained by shallow water depths.

Alternative 3 (Partial Replacement) and Alternative 4 (Full Replacement) are able to be constructed with more traditional methods. These alternatives will require phased approaches to minimize operational impacts to the terminal.

6.0 PREFERRED ALTERNATIVE SELECTION

The preferred alternative is heavily reliant on both budgetary concerns for project funding as well as fulfilling a legal and moral obligation to the people of the Vashon Island community. It cannot be understated the importance of the Vashon terminal to the everyday lives of the citizens of Vashon Island. As such, not providing a means for the residents to access the mainland after a catastrophic earthquake would be unjust. However, this must balance with the overhanging issue of available budget. This balance is achieved with Alternative 3 – Partial Replacement or Vital Link

6.01 Trestle Structural

Alternative 3 will provide a vital link that will continue to provide the people of Vashon Island a means to travel between the mainland and the island in the event of an earthquake while structural repairs are performed on the portion of the trestle not replaced by this alternative. The alternative proposes to replace approximately 40,000 sf of trestle.

6.02 Bulkhead/ Seawall Structural

The entire bulkhead/seawall is replaced under this alternative and will be forward designed to be compatible with a full replacement of the trestle when funds are available.

6.03 Terminal Building & Waterside Enclosures

This alternative fully replaces the aged terminal building. The proposed building will be located immediately shoreward and adjacent to the existing building. It could consist of 1 or 2 stories to provide both employee (2nd floor) and passenger (1st floor) areas. It would be constructed prior to the removal of the existing terminal building in an effort to reduce overall interruption of service. It could be constructed on site or we could install a pre-fabricated terminal building to reduce impacts to our customers. Providing the building as 2 stories will allow for an increase in usable square footage while minimally increasing overwater coverage.

6.04 Pavement

The pavement decking for the holding lanes, exit lanes, and sidewalk is replaced under this alternative per current WSF Standards.

6.05 Utilities

The existing utilities which currently parallel the western side of the trestle will be replaced and updated to current standards. As it is not identified in the 16-year plan, the existing electrical system is not anticipated to be expanded to accommodate the addition of a hydraulic transfer span,

The preliminary alternatives for rehabilitation do not specifically trigger treatment requirements, but it is assumed that the structure will provide basic water quality treatment (reduction in total suspended solids) as a goal.

Localized treatment strategies using media filter cartridge or bio-retention structures appear to be the most feasible, with a linear sand filter also being a potential solution in selected alternatives. Treatment strategies that use an upland site are the least feasible due to structural

and space constraints. Consolidated facilities located at multiple locations on the structure may be feasible but limited by other structural considerations such as available freeboard, trestle structural design, and deck grading limitations.

Consistent with the recommended treatment strategies, surface runoff or possibly trench drains should be considered for conveying runoff to the treatment facilities. Deck drains introduce additional complications to the placement of treatment facilities and are not recommended.

6.06 Signage

Static and variable message signing will be provided as part of the preferred alternative. The existing sign bridge requires replacement.

6.07 Security

The updated terminal building will provide for modern security measures in line with current USCG and TSA standards and the WSF Terminal Design Standards, 2012.

6.08 Environmental

Environmental concerns are partially addressed under this alternative and project elements will be compatible with a future full build needs to accommodate treatment of stormwater, removal of all creosote timbers, and maintaining an equivalent amount of overwater coverage.

6.09 Maintenance and Operations

The Vashon Terminal and site will receive the same WSF level of staffing as the existing building currently receives. Eagle Harbor Maintenance provides building infrastructure and utilities maintenance, and equipment support. The terminal staff provides routine cleaning of the facility as a common practice of WSF. This practice is expected to continue in the new terminal building and site. Electrical and heating costs should be higher with a larger building; however, the LEED silver certified design should offset some of the increased costs and will provide better energy control systems and human comfort.

The associated maintenance and operations of this alternative is significantly less than the No-Build and Rehabilitation alternatives. The replaced portions of the trestle will require significantly less maintenance than in the existing condition. However, the portion of the trestle that is not replaced will require maintenance levels similar to existing conditions and will require increasingly higher levels of maintenance as components further deteriorate until they are replaced in later phases..

Terminal operations will not require additional personnel under this alternative. The overall operations of the terminal will likely become more efficient in that the deficiencies that are currently experienced by the terminal can be addressed during the design of the replacement trestle and terminal building.

6.10 Cost

The estimated cost of this alternative is \$35.5M. An additional \$5M is estimated to be required for the future replacement of the eastern half of the trestle.

Operating Budget Impacts

Life Cycle Cost Analysis

C3 Form

6.11 Permitting

The required permits for this alternative will include:

- Corps of Engineers (COE)
- Shoreline, Coastal Zone Management Certification (CZM),
- Hydraulic Project Approval (HPA) and
- Water Quality Certification (Ecology)
- Incidental Harassment Authorization (NOAA)
- Building Permit (King County)

6.12 Risk

Items that may place the project at risk under the preferred alternative are discussed below. See Appendix H for a detailed Risk Matrix developed for the preferred alternative.

Tribes

Federal funding might be used to supplement the budget for this project. Any alternative that does not remove creosote and/or increases overwater coverage, runs the risk of having the tribes oppose the Corps Permit application. When WSF first met with the Puyallup Tribe, they were told 1) the proposed project would remove all creosote treated timbers, 2) the project proposed has no additional overwater coverage other than perhaps a slight widening to meet ADA/sidewalk standard widths (though we offered mitigation), and 3) the project proposed to treat surface runoff from the trestle. The current rehabilitation alternative does none of these so it can be assumed the Puyallup Tribe may oppose this alternative.

Environmental

Environmental Services will require mitigation for any additional overwater coverage. NOAA has adopted the Puget Sound Chinook Salmon Recovery Plan which states "...protecting existing habitat is the most important action needed in the short term."

NMFS (NOAA), US Fish & Wildlife, Washington State Department of Fish & Wildlife oversee the protection of salmon, marine mammals, orcas, and other ESA listed species, bull trout, marbled murrelet.

Seismic

Overall impact on an island dependent on a ferry for public transportation and services

Community

Neighbors of small homes and a small restaurant will be impacted by upland construction.

Disruption and/or loss of capability of children to commute from Kitsap County and West Seattle to McMurry Middle School and Vashon High School.

Permits

A new two-story terminal building allows for a reduced footprint but may not receive a building permit

Other Alternatives

A trestle refurbishment project of this magnitude has not been performed by WSF, nor has a WSF project been justified with an asset management model. The risk exists that after construction of phase 1, construction mobilizes 5 years later for phase 2 and discover the decision to implement Alternative 2B wasn't as wise a decision as we'd envisioned; there are more problems with refurbishment than we had anticipated. There's a good possibility the economy will recover over the next 5 years and we'll find ourselves second guessing our earlier decision, wondering if we should move forward with the remaining phases. There's the possibility of not pursuing phases 3 through 5 and scrapping the entire refurbishment idea. We could abandon that strategy and end up throwing away our investment and starting all over with a traditional replacement alternative.

6.13 Construction

The project will be completed in seven major phases. During the first phase, upland modifications and pedestrian accommodations would be implemented. This phase includes a 650-ft temporary elevated pedestrian walkway constructed along the east side of the existing trestle to safely convey pedestrians around the construction zone. This results in a temporary increase in overwater coverage. This phase includes attaching temporary utilities to the temporary walkway and constructing an upland temporary bus and ADA drop off area for passengers.

The second phase will replace the bulkhead/seawall and install a stormwater treatment facility immediately behind the bulkhead/seawall. The second phase would also include demolishing the existing utilities along the west side of the trestle, and demolishing approximately 350-ft of nearshore pedestrian and exit lanes. This phase would conclude with the replacement of approximately 350-ft of pedestrian and exit lanes.

In the third phase, approximately 350 additional feet of pedestrian, exit lanes, and a trestle section adjacent to the terminal building, all along the mid-section of the trestle, would be demolished and replaced.

The fourth phase constructs a new terminal building over newly constructed trestle immediately south or shoreward of the existing terminal building. Connect utilities to the terminal building and energize/activate utilities.

The existing terminal building is demolished during the fifth phase.

The sixth phase demolishes and reconstructs approximately 100-ft of trestle, full width, between the new terminal building and the four berthing structures (passenger-only, 2 main slips, tie-up slip).

Lastly, the seventh phase removes temporary facilities.

Bulkhead/Seawall Phasing

Replacement of the bulkhead/seawall will be completed in two sub-phases in order to maintain vehicular access to the terminal. The construction would result in a large excavation in front of the terminal so it made sense to install the proposed stormwater treatment facility at the same time since it will be located adjacent to the bulkhead/seawall. This entryway to the terminal will be completed upon receiving new asphalt and stripping.

Terminal Building & Pedestrian Access Phasing

Reroute pedestrian traffic, maintain use of existing terminal building until replacement facility is functional.

It is critical to maintain safe pedestrian access throughout construction from the street to the terminal building and slips.

- Pedestrian Corridor during Construction: It would be acceptable to allow pedestrian access to cross traffic lanes during certain periods of construction, as long as traffic control and perhaps illumination is provided to assure safety. Customers would walk along a 650-ft long walkway located adjacent to the trestle on the east side. The temporary walkway would remain in place until the permanent walkway is reconstructed.
- Holding Shelter for Passengers: Customers will continue to use the existing terminal building until a new terminal building is constructed on a newly constructed trestle foundation, adjacent to the existing terminal building.

Interim Utilities

Temporary utilities would be attached to the temporary pedestrian walkway along the east side of the trestle.

Operations/Traffic Control during Construction

During the early construction phases when the bulkhead/seawall, stormwater treatment facility and near shore portion of trestle are being replaced, even with a temporary walkway being constructed along the east side of the trestle, there will only be enough space for one or two vehicular lanes. This portion of trestle is the narrowest section of trestle at Vashon. Measures will be taken to minimize the duration of this work and minimize the disruption to our customers. This will require holding traffic upland with ITS solutions and traffic flow alterations on 103rd Ave SW.

Similarly, during the latter phases of construction, when replacing the section of trestle that abuts the bridge seats, slips will be closed one at a time resulting in a reduction of service.

Operations will reach out to our customers during these periods to provide additional assistance in scheduling their crossings.

- Impact to WSF and KC Sailings: It is possible a different sailing schedule may be necessary to accommodate construction for a period of time. Need to coordinate with KC Passenger Only Ferry service.
- Minimum Trestle Lane Requirements During Construction: WSF Operations personnel has stated that 3 lanes plus a pedestrian walkway is preferred throughout construction, as a minimum requirement. WSF may be able to adjust that requirement depending on circumstances. WSF Operations would like to maintain 2 holding lanes, 1 exit lane, and 1 pedestrian access lane open throughout construction,. It was noted above that the temporary pedestrian walkway would be located along the east side of the trestle, not over the existing trestle footprint. WSF Operations noted that it is acceptable to operate with only 1 holding lane, 1 exit lane, and 1 pedestrian access lane for a temporary solution during the winter months. Under this minimal configuration, WSF Operations proposes to keep all vehicle holding upland and use the 2 remaining lanes for unloading during the afternoon peak period
- Access to the Tie-Up Slip: Access will be maintained through all phases to the tie-up slip
- Management of Upland Holding During Construction: It is anticipated that the remaining vehicle holding will be located upland during construction and will require 2 traffic flaggers
- Adjustment to Sailing Schedule during Construction: It is anticipated that WSF Operations will rewrite the sailing schedule to include reduced ferry service. The main focus at Vashon is the commute base traffic; some summer festival weekends will result in increased ridership. It is also possible that WSF could add sailings on specific weekends if needed depending on the construction schedule.
- Reduction to 2-Boat Service During Construction: WSF may reduce operations to a 2-boat service if necessary to accommodate construction, including slip closures.
- Temporary Reroute of Vashon-Southworth Route: WSF may be able to reroute the Southworth route during construction, if necessary. However the 7:55 AM route which carries the school bus passengers is very important.
- Construction Phasing (Preliminary): Each of the primary construction phases will have sub-phases to be determined by the contractor. The schedule for advertisement needs to take into account the fish window for pile driving. WSF suggests dividing the east and west sections by splitting the preferential loading lane. If separate pedestrian access is provided, vehicles can use the existing sidewalk

6.14 Schedule

The project is currently schedule to go to Ad in April 2014 and has a completion date of May 2018. Based on the current schedule, it is anticipated the project's Ad date will slip one year. It is assumed that the preferred alternative will be able to be constructed in 2-3 years.

The schedule currently indicates that the AD date will be one month beyond the legislative milestone. The schedule also includes putting the PS&E on the shelf for approximately one

year while waiting for construction funding. This schedule was refined to account for staff availability and the use of consultants to supplement State resources to maintain the design schedule. The construction phase is anticipated to last approximately two years, covering two “fish windows” for in-water construction. A proposed design and construction schedule was created for the Project Procedures Manual and is included in Appendix E of this report. A detailed construction schedule will be developed with Construction Management as part of 30% design. The table below summarize the major milestones of the project based on the current schedule:

Table 16: Project Milestones

SCHEDULE MILESTONE	WSF REPORT DATE	LEGISLATIVE REPORT DATES
Preliminary Engineering Phase Start	Aug 2010	Dec 2009
Pre-Design Study Complete	Dec 2012	
Design Approval	Feb 2013	
Environmental Review Complete	Feb 2013	Dec 2011
30% PS&E Complete	Apr 2013	
60% PS&E Complete	Jul 2013	
90% PS&E Complete	Oct 2013	
Final PS&E Complete	Jan 2014	
Right-of-Way Certification	NA	
Contract Advertisement	Apr 2014	Apr 2014
Bid Opening	Jun 2014	
Contract Execution (Construction Start)	Jul 2014	
PE Phase End (Final Record Closeout)	Oct 2014	
Operationally Complete (Construction Complete)	2017	May 2018

Schedule risk items include:

- Environmental permits
- In-water construction fish window
- Peak travel season operational requirements
- Long lead time items & Buy America requirement

6.15 Project Management

Design, bid, build will be the method for delivery of the recommended alternative for the Vashon Trestle Replacement Project. Construction Management will be performed by WSF.

6.16 Assumptions

General assumptions for the selection of the preferred alternative include:

- Allowed to modify overwater coverage to better suit operational needs but will maintain no net increase of overwater coverage.
- Restore 3-boat service. Develop a construction phasing plan that allows the terminal to operate as close to normal as possible; perhaps with a reduced 2-boat service schedule.
- Maintain use of terminal building until replacement building is available.
- Maintain access to King County's Passenger-Only Ferry Service.

7.0 PROJECT DRAWINGS/ DIAGRAMS

Project drawings and diagrams are included in Appendix B of this document.

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APPENDICES

Appendix A – References

Appendix B – Site Plans

Appendix C – Estimates

Appendix D – Asset Management Model

Appendix E – Schedule

Appendix F – Existing Facility Photographs

**Appendix G – Excerpts from “Vashon Trestle Replacement Concept & Cost Analysis”
Technical Memorandum**

Appendix H – Risk Matrix

Appendix I – Alternatives Matrix